MONTHLY WEATHER REVIEW

Editor, EDGAR W. WOOLARD

VOL. 67, No. 11
W. B. No. 1283

NOVEMBER 1939

CLOSED JANUARY 3, 1940
ISSUED FEBRUARY 23, 1940

MISSISSIPPI RIVER WATER TEMPERATURES AT NEW ORLEANS

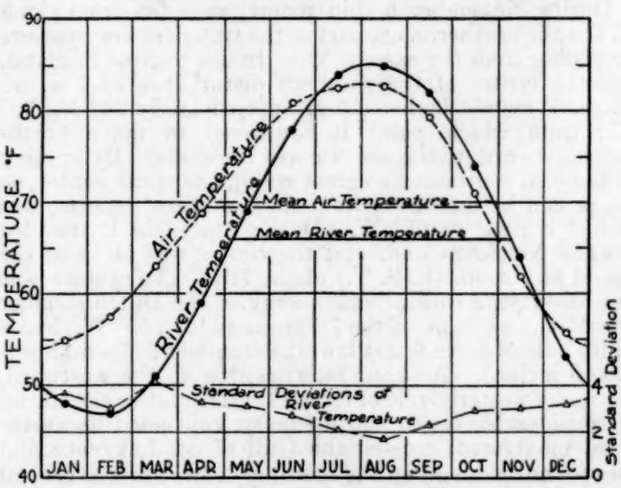
By A. A. HIRSCH

[Chemical Engineer, Sewerage and Water Board of New Orleans, March 1939]

Temperatures of Mississippi River water, being of interest in water treatment, are recorded on about 5 days each week at the Carrollton Purification Plant. A quart sample is taken from the influent to the grit reservoirs; although this sampling point is about three quarters of a mile distant from the intake, calculation indicates that, because of the insulation afforded by the earth cover, no appreciable change in temperature of the water occurs during travel through the 48-inch low-lift main. No high degree of accuracy is claimed for the data, however, since readings have been made with various thermometers, and by many different individuals having a wide range of personal equations. Observational errors are probably greatest under winter conditions when cold water samples are brought into a warm laboratory; postponing the reading of a thermometer, in such a case, for 5 minutes may cause a positive error as large as 2° F.

Monthly average temperatures for the 24-year period 1915–38, inclusive, are given in table 1, and are plotted in the accompaning figure; abscissae are at the midpoints of the months.

The average monthly air temperatures for a 68-year period, obtained from Weather Bureau tables, are also



plotted in the figure. The minimum air temperature is reached much sooner in winter than the minimum water temperature; however, in summer, the air-temperature maximum is reached only a few days before the water-temperature maximum. Points of intersection of the two curves, in early July and early December, divide the year into a long interval of over 7 months, early in the year, during which the average air temperature is greater than that of the river water, and a short period of almost 5 months during which the river water is slightly warmer than the air. Since the river flows southward from a generally colder region it can readily be understood how the winter water temperature is below local mean air temperature; but the fact that the water temperature in midsummer is higher than local air temperatures is more difficult of interpretation. The following factors are suggested: (1) Sampling is done at midday, and errors caused by postponed readings increase the temperature of the sample according to the prevailing noon summer temperature; (2) during stream flow, water temperature is increased directly by solar radiation, and this factor is capable of accounting for a temperature rise of approximately 9° in July, if insolation is estimated at 500 gram-calories per square centimeter per day.

TABLE 1.—*Monthly average Mississippi River water temperatures at New Orleans.* ° *F.*

Month	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	Average	Standard deviation
January	43	46	47	48	47	49	53	48	46	46	43	46	45	43	47	47	46	54	51	48	48	47	60	47	48	3.7
February	45	45	46	51	46	50	52	45	45	43	44	46	47	44	46	47	48	55	50	49	46	43	50	50	47	3.0
March	43	44	55	58	52	51	60	49	50	44	49	49	50	47	48	52	51	55	54	50	54	51	54	57	51	4.2
April	57	55	61	63	62	60	64	63	60	52	61	54	53	55	62	57	56	60	60	59	62	58	60	62	59	3.3
May	78	66	67	70	67	67	70	71	68	67	66	63	69	64	68	71	66	70	73	71	69	72	70	72	69	3.1
June	79	75	77	82	76	77	82	79	77	75	71	78	79	76	75	77	77	81	79	80	76	82	81	79	78	2.7
July	81	79	81	83	87	83	88	83	82	82	86	83	83	82	83	84	84	85	83	86	82	85	85	84	84	2.1
August	82	83	85	85	89	86	88	84	84	85	85	85	86	83	84	82	83	87	84	86	87	86	86	85	85	1.7
September	77	80	80	82	82	84	87	83	80	80	85	83	86	82	81	81	82	82	84	81	80	86	83	83	82	2.3
October	70	70	72	73	83	74	74	75	72	73	80	69	72	75	74	75	77	72	74	75	74	75	74	74	74	2.9
November	65	61	61	66	67	65	67	66	57	66	63	58	63	67	64	64	68	62	63	66	65	59	59	64	64	3.0
December	51	50	54	61	50	54	55	55	52	54	51	51	52	53	50	54	60	51	59	50	51	53	49	50	53	3.2
Average	65	63	65	69	64	67	70	63	64	64	65	64	65	64	66	66	67	69	68	67	66	66	68	67	66	1.8

The maximum difference between air and water temperatures, amounting to slightly over 10° F., occurs at the time of minimum river temperature in mid-February; in summer the largest difference (in the opposite direction) is only about 2.5° F. The water temperature curve is the more symmetrical; river temperatures, owing to the great bulk of the water mass, naturally exhibit a smoothed effect of the factors influencing the seasonal temperature variation. The river temperature curve is closely a sinus soidal wave, having nearly a 2-month lag in its minimum and approximately a 1½-month lag in its maximum behind the winter and summer solstices, respectively.

DISTURBANCE OF OCTOBER 29–NOVEMBER 8, 1939

By WILLIS E. HURD

The fifth tropical disturbance of 1939 originated from a shallow low-pressure wave in the southwestern Caribbean Sea on October 27. A slow north-to-northwest movement of the wave, with equally slow fall in barometer, occurred until 7 p. m. (E. S. T.) of the 29th, when a cyclonic circulation became more developed, with center not far to the southward of Swan Island. At the morning observation of the 30th the center was close to the westward of Swan Island, where the barometer read 1,004.7 millibars (29.67 inches), wind south-southwest, force 5. During the day of the 30th the disturbance curved into a northeasterly direction, the center passing to the north of Swan Island where, at 7 p. m. (E. S. T.), the barometer had fallen to 1,003.4 millibars (29.63 inches). Up to that time no gales had been reported in connection with this disturbance. But at midnight of the 30th-31st the American steamer *Olancho*, Santa Marta toward Barrios, experienced a gale of force 8. The ship's position at 4 p. m. of the 30th was in 16°25′ N., 83°53′ W., where she had lowest barometer, 1,005.1 millibars (29.68 inches).

During the 31st the disturbance increased in intensity, and was locally of hurricane force as it passed over the Cayman Islands during the afternoon. At Grand Cayman the maximum wind velocity was 92 miles an hour, and the lowest pressure, at about 3:30 p. m., was 990.5 millibars (29.25 inches). Press reports indicate considerable damage on the islands, and the loss of four schooners. The strongest wind reported by a ship on the 31st was from the northwest, force 9, experienced by the American steamer *Memphis City* near 21° N., 85° W., at about 7 a. m., ship's time. The ship was at that time considerably to the west-northwest of the storm center, then near 19° N., 82° W.

After leaving the Caymans, the cyclone took an east to east-by-south course toward Jamaica, and at 7 p. m. (E. S. T.) of the 31st, while yet moderate to strong northerly gales were blowing at Grand Cayman, strong southerly gales were battering the western extremity of Jamaica. At 7 a. m. (E. S. T.) of November 1 the center lay close off the northwest coast of Jamaica, where there was heavy property damage, particularly at Montego Bay, according to press reports. Here the high waves forced scores of families to leave their homes, and one life was lost. Heavy rains also added materially to the damage done on the island. During the day a few ships well to the westward of the storm center reported northerly gales of fresh to strong force along the eastern slope of a high pressure area central over the extreme southern Gulf States.

During the 2d and 3d of November the storm center, of lessened energy except for local manifestations, moved very slowly and capriciously, but generally eastward, between Jamaica and eastern Cuba, accompanied by strong winds and torrential rains. Floods in the southern Cuban rivers resulted in damage to crops and livestock and the loss of one life. Even as far to the eastward as Haiti some damage was done in coastal localities by the high seas. The strongest winds reported during the 2 days was encountered by the Honduran steamer *Amapala* on the 3d. At 8 a. m. this ship, in 18°37′ N., 76°05′ W., had an east-southeast gale of force 10, barometer 997.3 millibars (29.45 inches). This reading is the lowest reported by a ship during the course of the storm in the Caribbean Sea. Between the *Amapala* and the Cuban coast two other ships, at 7 a. m., reported east gales of force 8 to 9, but with much higher barometers. At 7 p. m. (E. S. T.) of the 3d a ship near 19° N., 76° W., had a southeast gale of force 9, but with only moderately low barometer.

Outside of the immediate area of the disturbance, in the eastern Gulf of Mexico, the Florida Strait, and off the southern Atlantic coast, there were strong northeasterly winds, but these were more related to the anticylcone over the United States than to the Caribbean disturbance.

During the 4th the LOW center moved slowly northward across eastern Cuba. At 7 p. m. (E. S. T.) of that day the barometer at Guantanamo read 1,003 millibars (29.62 inches.) In the neighboring sea area the highest wind noted for the day was of force 8, from the southeast, at 4 p. m., lowest barometer 998.6 millibars (29.49 inches), reported by the American steamer *Margaret Lykes*, in 21°00′ N., 75°15′ W. The wind on ship changed to northeast, force 8, at 6 p. m.

Farther northward the high pressure was giving way, and by the morning of the 5th the disturbance was central over the southeastern Bahamas, with a shallow trough of low pressure extending northward to the New Jersey coast, where another LOW center had formed since the preceding night.

The tropical center at 7 p. m. (E. S. T.) of the 5th lay near 25° N., 72° W., now moving north-northeastward with greatly increased rapidity. The American steamer *Delfina* reported the heaviest wind, force 9 from southwest, in connection with it, in 27° N., 71° W., at 11 p. m. The ship's barometer at that hour was 993.2 millibars, 29.33 inches. The more northerly center then lay off the southern New England coast. During the afternoon hours it caused gales of force 9–10, as reported by ships, within the region 37° to 40° N., 69° to 74° W.

During November 6 ship reports were few from along all but the northernmost part of the trough of low pressure extending from the eastern West Indies to New England, but the center of the southern disturbance at 7 a. m. (E. S. T.) could be located at approximately 29° N., 70° W., from which point it continued to move north-northeastward, to the westward of Bermuda. By evening of the 6th, continuing at great speed, the storm center, so far as can be estimated from the few ships' reports, was in 39° N., 64° or 65° W. During the night it traveled toward Newfoundland, and the center was close to the island at 7 a. m. (E. S. T.) of the 7th. The cyclone was now displaying considerable energy. The Dutch steamer *Veendam*, at 6 a. m. of the 7th, near 44° N., 55° W., had a south gale of force 9 and lowest barometer 995.5 millibars (29,40 inches). An hour later, a little to the westward, she met a westerly gale of force 11. Thereafter the storm, of considerable depth and intensity, continued its northward movement, crossed the Gulf of St. Lawrence and Newfoundland, and on the morning of the 8th was central to the eastward of Labrador.

Quoting from the report of Grady Norton, forecaster on duty at our Jacksonville office, regarding the disturbance in its tropical stages:

> An interesting and somewhat disconcerting aspect of this disturbance was the occasional breaking away of large blocks of tropical air, with attendant waves of falling pressure, which formed secondary disturbances off the South Atlantic coast, which in turn

moved northward and formed vigorous storms. It is believed that the energy thus released was a factor in preventing a more severe development of the original tropical center.

The first bulletin relative to this disturbance was issued from the Weather Bureau office, Jacksonville, Fla., on October 30, and was followed at frequent intervals by timely bulletins and advisory warnings until November 6.

The track of this disturbance, together with the tracks of preceding tropical disturbances of the year, will appear in the December issue of the REVIEW.

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By AMY P. LESHER

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SOLAR OBSERVATIONS

[Meteorological Research Division, EDGAR W. WOOLARD in charge]

SOLAR RADIATION OBSERVATIONS, OCTOBER 1939

By IRVING F. HAND

Measurements of solar radiant energy received at the surface of the earth are made at nine stations maintained by the Weather Bureau, and at ten cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Washington, D. C., Madison, Wis., Lincoln, Nebr.) and at the Blue Hill Observatory at Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau stations at Washington and Madison.

The geographic coordinates of the stations, and descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data, obtained up to the end of 1936, will be found in the MONTHLY WEATHER REVIEW, December 1937, pp. 415 to 441; further descriptions of instruments and methods are given in Weather Bureau Circular Q.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parentheses). At Madison and Lincoln the observations are made with the Marvin pyrheliometer; at Washington and Blue Hill they are obtained with a recording thermopile, checked by observations with a Marvin pyrheliometer at Washington and with a Smithsonian silver disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 7:30 a. m. and at 1:30 p. m. (75th meridian time).

Table 2 contains the average amounts of radiation received daily on a horizontal surface from both sun and sky during each week, then departures from normal and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the records of the Eppley pyrheliometer recording on either a microammeter or a potentiometer.

Direct radiation intensities averaged below normal at Washington, Madison, Lincoln, and Blue Hill.

Total solar and sky radiation was above normal at all stations except La Jolla, Twin Falls, and Miami. Data for the missing stations will be published as soon as they are available.

Polarization observations made at Madison on 3 days give an average of 64 percent, with a maximum of 69 percent on the 1st. These are close to normal for November.

LATE REPORTS

The total solar and sky radiation values obtained at Twin Falls for the weeks beginning Sept. 3, 10, 17, and 24, and Oct. 1, 8, 15, and 22 are 488, 368, 436, 393, 207, 290, 296, and 229 respectively, with corresponding departures of +8, −82, +26, +26, −157, −57, −29, and −61. Similar data for the same weeks in October at Miami are 373, 364, 307, and 363, with corresponding departures of −27, −5, −51, and −26.

TABLE 1.—*Solar radiation intensities during November 1939*

[Gram-calories per minute per square centimeter of normal surface]

WASHINGTON, D. C.

Date	Sun's zenith distance: 7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.0°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass: A. M.					P. M.				Local mean solar time
	e	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Nov. 13	4.17	.....	1.02	1.10	1.23	.....	.....	.....	.....	.....	2.69
Nov. 15	4.57	0.40	.48	.69	1.07	.....	.....	.....	.....	.....	5.79
Nov. 16	3.63	.85	1.00	1.18	1.32	.....	.....	.....	.....	.....	2.16
Nov. 17	4.57	.66	.79	1.00	1.07	.....	1.05	.....	.....	.....	4.17
Nov. 24	3.00	.64	.....	.....	.....	.....	.....	.....	.....	.....	3.81
Nov. 27	1.68	.95	.....	.....	.....	.....	.....	.....	.....	.....	3.30
Nov. 28	4.57	.62	.75	.99	1.32	.....	.....	.....	.....	.....	3.45
Nov. 29	3.30	.87	1.01	1.10	1.34	.....	.....	.....	.....	.....	2.62
Means	.....	.71	.84	1.01	1.22	.....	(1.05)	.....	.....	.....	.....
Departures	.....	−.04	−.05	0.00	+.03	.....	−.13	.....	.....	.....	.....

MADISON, WIS.

Nov. 2	3.15	.....	.....	1.24	1.39	1.57	.....	.....	.....	.....	2.87
Nov. 3	2.87	.....	.....	1.21	.....	.....	.....	.....	.....	.....	2.62
Nov. 8	2.87	.....	.....	.....	1.42	.....	.....	.....	.....	.....	2.74
Nov. 11	1.96	.....	.....	.....	.....	.....	.....	1.13	.....	.....	2.74
Nov. 13	3.30	.....	.....	.....	1.02	.....	.....	.....	.....	.....	4.17
Nov. 14	3.99	.....	.....	.....	.....	.....	.....	1.03	.....	.....	4.75
Nov. 16	4.57	0.79	1.02	1.14	.....	1.62	.....	1.13	.....	.....	4.75
Nov. 17	5.36	.75	.94	1.05	.....	1.59	.....	1.15	.....	.....	6.27
Nov. 27	2.62	.95	1.05	1.22	.....	1.67	.....	1.21	.....	.....	4.17
Nov. 28	2.87	.86	.95	1.13	.....	1.48	.....	1.05	.....	.....	3.81
Means	.....	.84	.99	1.16	1.28	1.58	.....	1.12	.....	.....	.....
Departures	.....	−.05	−.01	0.00	−.03	+.03	.....	0.00	.....	.....	.....

LINCOLN, NEBR.

Nov. 1	1.78	.....	1.13	1.26	1.43	.....	.....	.....	.....	.....	2.49
Nov. 3	1.96	.80	.67	.92	1.21	.....	.....	1.20	1.05	0.93	2.87
Nov. 4	1.96	1.02	1.16	1.27	1.42	.....	.....	.....	.....	.....	2.62
Nov. 8	3.30	.79	.94	1.17	1.37	.....	.....	1.14	1.02	.90	3.45
Nov. 10	2.36	1.03	1.15	1.29	1.42	.....	.....	1.28	1.11	.98	2.16
Nov. 14	3.15	.97	1.08	1.25	1.42	.....	.....	1.25	1.11	.96	3.30
Nov. 15	3.45	1.02	1.12	1.29	1.47	.....	.....	1.21	1.06	.95	3.63
Nov. 16	3.63	.93	1.06	1.18	1.36	.....	.....	1.19	1.00	.82	4.57
Nov. 20	2.16	.72	.79	.94	.....	.....	.....	1.02	.89	.76	4.57
Nov. 21	2.16	.77	.63	.81	1.37	.....	.....	.....	.....	.....	3.99
Nov. 22	1.60	.35	.41	.67	.....	.....	.....	1.19	1.09	.97	4.75
Nov. 27	1.96	.51	.73	.91	.....	.....	.....	1.04	.89	.76	3.45
Nov. 29	3.63	.47	.59	.79	.....	.....	.....	.90	.77	.65	5.16
Means	.....	.76	.88	1.06	1.39	.....	.....	1.14	1.00	.87	.....
Departures	.....	−.14	−.14	−.11	+.03	.....	.....	−.04	−.04	−.05	.....

BLUE HILL, MASS.

Nov. 1	4.2	0.81	0.96	1.11	1.25	.....	1.20	1.00	.....	.....	3.6
Nov. 2	4.4	.51	.63	.77	.98	.....	.....	.....	.....	.....	4.6
Nov. 3	3.6	.82	.91	1.04	1.19	.....	1.20	1.07	0.96	0.85	5.6
Nov. 4	2.8	.77	.87	1.00	.....	.....	1.18	1.00	.86	.75	4.4
Nov. 6	3.2	.90	1.00	1.12	1.25	.....	1.25	1.05	.91	.79	4.6
Nov. 7	3.3	.56	.73	.88	1.26	.....	.....	.....	.....	.....	4.0
Nov. 9	2.9	.....	.....	.....	1.30	.....	1.29	1.06	1.05	.93	1.9
Nov. 11	4.4	.....	.....	1.05	1.16	.....	1.15	1.04	.88	.76	3.0
Nov. 12	2.8	.84	.95	1.06	1.21	.....	1.21	.....	.....	.....	2.8
Nov. 14	1.3	.87	.99	1.08	1.23	.....	1.23	1.11	.98	.91	1.7
Nov. 15	2.2	.93	1.01	1.12	1.27	.....	1.27	1.12	.98	.91	3.3
Nov. 17	4.2	.....	.....	.....	1.28	.....	1.28	1.13	1.01	.90	2.8
Nov. 18	2.8	.....	.....	.....	.....	.....	.97	.71	.56	.41	4.6
Nov. 23	2.9	.85	.95	1.05	1.21	.....	1.21	1.03	.86	.77	4.0
Nov. 26	2.1	.....	.....	.....	.....	.....	1.28	1.21	1.13	1.06	.9
Nov. 28	3.2	.....	.....	.97	1.17	.....	1.17	.94	.83	.73	3.5
Nov. 29	3.2	.74	.85	.98	1.11	.....	.....	.....	.....	.....	3.8
Means	.....	.78	.89	1.02	1.19	.....	1.21	1.04	.92	.82	.....
Departures	.....	−.13	−.12	−.10	+.03	.....	−.04	−.06	−.05	−.01	.....

[1] Extrapolated.

TABLE 2.—*Average daily totals of solar radiation (direct+diffuse) received on a horizontal surface*

Week beginning—	Washington	Madison	Lincoln	Chicago	New York	Fresno	San Juan	Fairbanks	Twin Falls	La Jolla	Miami	New Orleans	Riverside	Blue Hill	Newport	Friday Harbor	Cambridge	Albuquerque
	Gram-calories per square centimeter																	
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Oct. 29	254	199	290	137	202	345	472	47	243	303	228	-------	337	248	255	199	223	458
Nov. 5	278	217	253	179	203	292	536	76	236	159	318	308	252	229	251	62	222	300
Nov. 12	274	237	240	210	246	288	408	32	208	334	223	119	306	259	278	78	234	402
Nov. 19	114	105	184	76	127	256	453	12	191	292	313	316	292	119	142	121	124	314
Nov. 26	155	115	158	80	141	228	436	12	102	286	322	262	255	200	191	96	173	186
	Departures of daily total normals																	
Oct. 29	+7	+12	+50	−18	+20	+1	+21	+8	+21	−13	−92	-------	+32	+22	+9	+64	-------	-------
Nov. 5	+51	+47	+7	+43	+45	−13	+94	+39	+26	−135	−24	+15	−49	+22	−1	−47	-------	-------
Nov. 12	+76	+89	+31	+98	+111	+33	−32	+3	+42	+31	−108	−102	+9	+101	+70	−12	-------	-------
Nov. 19	−71	−27	−23	−42	0	+18	+11	−6	+34	+10	−18	+63	+18	−28	−11	+15	-------	-------
Nov. 26	−9	−10	−28	−12	+26	+6	−4	−1	−50	+17	+33	+38	−3	+39	+10	+1	-------	-------
	Accumulated departures since January 1																	
	+17,584	+12,348	+7,763	+19,026	+8,167	+763	+10,057	−1,386	−2,681	+3,822	−6,440	-------	−4,555	+3,591	+3,136	+5,957	-------	-------

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, U. S. Navy (Ret.) Superintendent, U. S. Naval Observatory. Data from measurements at the U. S. Naval Observatory from plates obtained at the observatories indicated. Difference in longitude is measured from the central meridian, positive toward the west. Latitude is positive toward the north. Areas are corrected for foreshortening and expressed in millionths of Sun's hemisphere. For each day below longitude, latitude, area of spot or groups, and spot count, are given respectivel ' the assumed longitude of the center of the disk, assumed latitude of the center of the disk, total area of spots and groups, and total spot count]

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1939	A. m.		°	°	°	°				
Nov. 1	11 5	6662	−76	179	−7	75	436	12	G	U. S. Naval
		6661	−55	200	−18	58	145	10		
		6656	−4	231	−10	14	145	13		
		6657	+4	239	+5	4	630	39		
		6655	+11	266	+21	20	145	8		
		6652	+56	311	+13	55	97	1		
				(255)	(+4)		1,598	83		
2	11 8	6662	−63	178	−7	64	291	15	VG	Do.
		6661	−41	200	−18	46	194	13		
		(*)	−13	228	−17	24	48	4		
		6656	+9	250	−9	15	145	16		
		6657	+16	257	+5	17	679	45		
		6655	+24	265	+21	29	73	3		
		6652	+69	310	+13	67	97	2		
				(241)	(+4)		1,527	98		
3	11 16	6662	−49	179	−6	50	291	20	G	Do.
		6661	−28	200	−18	35	291	13		
		6663	−24	204	+20	28	24	3		
		6656	+23	251	−9	25	145	8		
		6657	+30	258	+5	30	630	20		
		6655	+37	265	+22	41	73	2		
		6652	+84	312	+14	83	97	1		
				(228)	(+4)		1,551	67		
4	12 37	6667	−75	139	+13	73	24	4	VG	Mt. Wilson
		6662	−35	179	−5	36	291	27		
		6661	−13	201	−17	24	242	35		
		6663	−9	205	+21	19	12	5		
		6665	−8	209	+13	10	12	1		
		6664	+2	216	−15	18	6	1		
		6656	+37	251	−9	38	97	3		
		6657	+44	258	+4	43	582	40		
		6653	+51	265	+21	53	73	4		
				(214)	(+4)		1,339	120		
5	13 2	6667	−60	141	+13	59	12	2	P	Do.
		6666	−39	162	−20	45	12	1		
		6668	−39	162	+9	38	48	4		
		6662	−21	180	−7	24	194	19		
		6661	+1	202	−17	20	242	10		
		6663	+4	205	+20	16	12	1		
		6664	+15	216	−16	24	12	1		
		6656	+51	252	−9	53	73	2		
		6657	+58	259	+4	57	436	18		
		6655	+63	264	+22	63	73	6		
				(201)	(+4)		1,114	64		

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1939	A. m.		°	°	°	°				
6	10 57	6668	−27	162	+10	27	48	7	VG	U. S. Naval.
		6662	−9	180	−7	13	194	22		
		6661	+13	202	−17	23	242	27		
		6663	+18	207	+19	23	48	2		
		6656	+63	252	−9	64	97	1		
		6657	+70	259	+5	69	436	15		
		6655	+77	266	+21	76	48	2		
				(189)	(+4)		1,113	76		
7	10 54	6669	−88	88	−20	88	12	1	VG	Do.
		6668	−12	164	+10	13	24	1		
		6662	+6	182	−7	11	145	15		
		6661	+28	204	−16	33	145	11		
		6663	+29	205	+19	33	97	12		
		6656	+78	254	−9	77	97	1		
		6657	+85	261	+4	85	388	5		
				(176)	(+4)		908	46		
8	11 26	6672	−80	82	+11	79	36	3	G	Do.
		6669	−75	87	−20	77	145	1		
		6671	−38	124	−10	40	36	5		
		6662	+20	182	−7	23	73	13		
		6661	+42	202	−17	46	145	15		
		6663	+43	203	+20	45	48	5		
				(162)	(+4)		483	42		
9	10 21	6672	−67	82	+10	66	170	7	G	Do.
		6669	−61	88	−20	64	97	4		
		6671	−23	126	−11	26	48	6		
		6670	+10	159	+13	13	48	6		
		6662	+33	182	−7	39	48	10		
		6661	+57	206	−17	60	48	4		
				(149)	(+4)		459	37		
10	11 26	6673	−68	68	−9	68	6	1	G	Do.
		6672	−53	83	+11	53	194	17		
		6669	−48	88	−20	53	61	3		
		6671	−9	127	−10	16	97	10		
		6670	+24	160	+14	25	145	21		
		6662	+47	183	−7	49	12	3		
		6661	+70	206	−16	72	48	1		
				(136)	(+3)		563	56		
11	10 53	6675	−83	40	+27	80	48	2	VG	Mt. Wilson.
		6673	−55	68	−9	56	97	30		
		6672	−39	84	+11	40	291	30		
		6669	−34	89	−21	40	24	2		
		6671	+7	130	−10	14	97	14		
		(*)	+10	133	+21	21	12	1		
		6674	+15	138	−19	26	24	4		
		6670	+43	166	+14	44	194	28		
		6661	+80	203	−16	80	24	2		
				(123)	(+3)		811	113		

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1939			°	°	°	°				
Nov. 12	11 4	6675	−70	40	+28	71	48	3	VG	Do.
		6676	−61	49	+6	60	73	10		
		6673	−43	67	−8	43	242	28		
		6672	−24	86	+11	25	485	52		
		6671	+20	130	−10	23	97	12		
		6674	+29	139	−19	36	12	2		
		6670	+58	168	+13	57	339	35		
				(110)	(+3)		1,296	142		
13	11 6	6675	−58	38	+29	61	97	1	G	U. S. Naval.
		6676	−46	50	+6	46	73	1		
		6673	−29	67	−8	31	291	11		
		6672	−11	85	+11	13	485	12		
		6671	+32	128	−10	33	48	1		
		6670	+70	166	+13	70	436	4		
				(96)	(+3)		1,430	30		
14	11 34	6677	−57	26	−16	60	73	5	G	Do.
		6675	−45	38	+29	50	73	1		
		6676	−32	51	+6	31	48	1		
		6673	−16	67	−8	19	388	16		
		6672	+2	85	+11	8	412	14		
		6671	+46	129	−9	47	12	1		
		6670	+82	165	+13	82	242	2		
				(83)	(+3)		1,248	40		
15	10 47	6679	−88	342	−8	88	388	1	G	Do.
		6677	−44	26	−16	48	339	21		
		6678	−33	37	−6	34	48	6		
		6675	−31	39	+28	39	97	1		
		(*)	−23	47	+6	22	24	5		
		6676	−17	53	+6	16	24	1		
		6673	−2	68	−8	10	388	19		
		6672	+15	85	+11	16	582	38		
				(70)	(+3)		1,890	92		
16	11 8	6679	−74	343	−8	75	388	2	VG	Do.
		6677	−29	28	−16	34	485	9		
		6678	−19	38	−6	22	48	6		
		6675	−19	38	+39	32	48	4		
		(*)	−5	52	+4	5	24	8		
		6676	−3	54	+7	5	24	1		
		6673	+12	69	−9	16	339	36		
		6672	+29	86	+11	30	582	48		
				(57)	(+3)		1,938	114		
17	10 48	6679	−60	344	−9	61	436	2	G	Do.
		6681	−31	13	+23	35	6	1		
		6677	−15	29	−16	24	582	20		
		6675	−6	38	+29	27	36	2		
		6678	−5	39	−7	11	12	5		
		6676	+11	55	+8	13	24	1		
		6673	+28	72	−10	31	121	23		
		6672	+41	85	+11	42	388	20		
				(44)	(+3)		1,605	74		
18	10 51	(*)	−50	341	+20	53	24	8	VG	Do.
		6679	−47	344	−8	49	388	1		
		6677	−2	29	−16	18	630	39		
		6675	+7	38	+28	27	24	3		
		6678	+8	39	−7	13	24	4		
		6676	+25	56	+7	26	24	1		
		6673	+41	72	−11	44	121	15		
		6672	+54	85	+10	55	194	18		
				(31)	(+2)		1,429	89		
19	10 53	6679	−33	344	−7	34	436	2	VG	Mt. Wilson.
		6681	−12	5	+22	23	6	2		
		6677	+13	30	−17	23	776	40		
		6675	+19	36	+28	33	24	1		
		6678	+23	40	−7	25	12	2		
		6673	+53	70	−11	54	73	8		
		6672	+68	85	+10	69	97	7		
				(17)	(+2)		1,424	62		
20	11 14	6679	−19	345	−7	22	242	3	VG	Do.
		6681	−2	2	+23	23	24	7		
		6677	+26	30	−17	32	873	28		
		6673	+67	71	−10	68	24	1		
		6672	+80	84	+10	80	48	2		
				(4)	(+2)		1,211	41		

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1939			°	°	°	°				
Nov. 21	11 5	6682	−73	278	−13	73	291	2	VG	Do.
		6679	−6	345	−7	10	291	3		
		6681	+14	5	+22	24	145	25		
		6677	+41	32	−17	45	1,067	40		
				(351)	(+2)		1,794	70		
22	11 8	6682	−68	270	−12	69	24	3	F	Do.
		6682	−62	276	−13	63	267	2		
		6679	+9	347	−7	12	291	4		
		6681	+30	8	+21	35	158	18		
		6677	+55	33	−17	57	1,067	12		
				(338)	(+2)		1,807	39		
23	11 37	6684	−87	237	−1	87	12	1	VG	U. S. Naval.
		6682	−56	268	−12	57	24	1		
		6682	−48	276	−13	50	242	2		
		6683	−25	299	−19	32	24	2		
		6679	+21	345	−7	23	485	9		
		6681	+42	6	+21	45	242	23		
		6677	+68	32	−17	70	1,067	15		
				(324)	(+2)		2,096	53		
24	11 29	6684	−64	247	−1	65	97	17	VG	Do.
		6682	−41	270	−12	44	48	2		
		6682	−35	276	−13	38	218	4		
		6679	+33	344	−7	34	485	8		
		6685	+35	346	+15	37	12	5		
		6681	+55	6	+21	56	291	21		
		6677	+79	30	−17	77	1,067	15		
				(311)	(+2)		2,218	72		
25	10 50	6684	−47	251	−2	48	97	10	G	Mt. Wilson.
		6682	−29	269	−13	33	48	9		
		6682	−22	276	−13	26	194	12		
		6679	+47	345	−7	50	291	3		
		6685	+50	348	+15	52	36	8		
		6681	+69	7	+21	70	194	13		
				(298)	(+2)		860	54		
26	13 00	6687	−37	247	−7	38	36	4	G	Do.
		6684	−32	252	−3	33	97	11		
		6682	−14	270	−13	21	36	4		
		6682	−7	277	−13	16	170	7		
		6686	−3	281	−5	7	121	9		
		6679	+60	344	−6	61	291	9		
		6685	+66	350	+15	67	24	6		
		6681	+80	4	+24	80	145	4		
				(284)	(+2)		920	54		
27	12 9	6687	−23	248	−7	24	36	8	VG	U. S. Naval.
		6684	−19	252	−3	20	121	12		
		6690	−14	257	−9	17	12	5		
		6689	−9	262	+6	11	24	9		
		6682	−2	269	−13	19	48	13		
		6682	+6	277	−13	15	121	2		
		6686	+8	279	−5	11	48	9		
		6688	+28	299	−17	33	36	4		
		6679	+74	345	−6	75	194	1		
				(271)	(+1)		640	63		
28	10 32	6687	−10	249	−9	14	121	6	P	Do.
		6684	−6	253	−3	8	145	8		
		6682	+20	279	−12	24	121	2		
		6686	+21	280	−3	22	48	2		
		6688	+40	299	−16	44	12	2		
				(259)	(+1)		447	20		
29	10 50	6687	+3	249	−8	9	315	32	G	Do.
		(*)	+3	249	−3	2	73	7		
		6684	+10	256	−3	11	73	1		
		6682	+32	278	−13	34	73	1		
		6686	+37	283	−4	38	6	1		
				(246)	(+1)		540	42		
30	15 16	6687	+20	250	−8	23	582	39	G	Do.
		6684	+26	256	−3	26	73	2		
		6682	+48	278	−13	52	73	1		
				(230)	(+1)		728	42		

Mean daily area for 30 days=1,233.

*=not numbered.
VG=very good; G=good; F=fair; P=poor.

PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR NOVEMBER 1939

[Dependent alone on observations at Zurich]

Data furnished through the courtesy of Prof. W. Brunner, Eidgen, Sternwarte, Zurich, Switzerland]

November 1939	Relative numbers	November 1939	Relative numbers	November 1939	Relative numbers	November 1939	Relative numbers	November 1939	Relative numbers	November 1939	Relative numbers
1	*a* --	11	*Eac* --	21	*d* 67	9	*Ec* 40	19	*Mc* 75	29	*a* 43
2	*Eac*? --	12	82	22	*a 65	10	*Mc* 46	20	50	30	43
3	72	13	--	23	62						
4	61	14	*Eac* 98	24	*Ec* 61						
5	*a* 58	15	*a* 87	25	58						
6	62	16	*d* 111	26	---						
7	*a* 66	17	---	27	*Mac* 62						
8	*Ec* 37	18	*b* 103	28	61						

Mean, 24 days=65.4.
a=Passage of an average-sized group through the central meridian.
b=Passage of a large group through the central meridian.
c=New formation of a group developing into a middle-sized or large center of activity; E, on the eastern part of the sun's disk; W, on the western part; M, on the central-circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.
*=Chur.

AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE in charge]

By B. FRANCIS DASHIELL

During November 982 radiosonde and airplane observations were made in the United States, Alaska, Canal Zone, Hawaii, and the West Indies. Of these, 819 were radiosondes, with 96, 88, 71, and 36 percent reaching 5, 10, 15, and 18 kilometers, respectively. Tables 1 and 1a show these observations, while pressures, temperatures, and resultant winds for 5,000 feet (1.5 kilometers), 3, 4, and 5 kilometers, are shown on charts VIII, IX, X and XI, respectively. Chart XII gives the isentropic data for November; tables 2 and 3 list the winds; and table 4 indicates the tropopauses. Effective November 15, 1939, the hour of all radiosonde observations was advanced to 1 a. m., 75th meridian time.

The mean free-air pressures at 5,000 feet (chart VIII) were lowest over the northeastern United States (Mount Washington, N. H., 840 millibars), the northern Great Lakes region (Sault Ste. Marie, Mich., 845 millibars), and thence northeastward over Canada (Newfoundland, 833 millibars). Pressure was lowest, however, in Alaska (Fairbanks and Juneau, 825 and 832 millibars, respectively). Mean pressures were relatively low along the Pacific coast, but the highest occurred over the central Rocky Mountain region, the South, and the Southeast (Durango, Colo., San Antonio, Tex., and Pensacola, Fla., 855 millibars).

At 3 kilometers (chart IX) the distribution showed a statistical LOW over Sault Ste. Marie, Mich., (699 millibars), and a HIGH over Pensacola, Fla. (714 millibars). Mean pressure continued relatively lower over the Pacific slope, but again the lowest pressure of the month occurred over Alaska (Fairbanks, 678 millibars).

Charts X and XI show the mean pressures at 4 and 5 kilometers, respectively. In the United States the lowest pressure persisted over Sault Ste. Marie, Mich., while the southern high-pressure area became definitely centered over Miami, Fla. Low pressure continued over Alaska, with Fairbanks having the lowest during November (592 and 514 millibars at 4 and 5 kilometers, respectively).

Above 5 kilometers the lowest pressures for the country were located over Sault Ste. Marie, Mich.; the pressures at Buffalo, N. Y., being only slightly higher. However, the lowest pressures noted during the month still persisted over the Alaskan stations, where Fairbanks was consistently lower than Juneau at all levels (decreasing steadily from a difference of 11 millibars less at 6 kilometers to 3 millibars less at 15 kilometers). The highest pressure in all upper levels prevailed at Miami, Fla., although relatively high pressures were found over the Southwest.

In the lower levels November mean free-air pressures were higher than during the preceding month. Maximum differences were noted at the surface, but these decreased slowly with altitude until no differences between the 2 months existed at 1.5 and 2 kilometers over the East and Southeast; at 2.5, 3, and 4 kilometers over the South, Southwest and Pacific States; and from 6 to 11 kilometers over the northern Rocky Mountain region. Above these levels the November pressures were lower than during the preceding month. This situation was particularly outstanding at 8, 9, 10, and 11 kilometers, where, in several instances, the current month was as much as 10 millibars lower. Above these levels the pressure differences decreased with altitude until the November pressure was from 1 to 2 millibars less than during October.

At stations where radiosonde observations have been conducted for a full year a comparison of November pressures with those recorded in the corresponding month of 1938 showed that consistently higher pressures prevailed during the current month at all levels over Omaha, Nebr., and Bismarck, N. Dak., (the latter being compared with Fargo, N. Dak.) But Nashville, Tenn., Okland, Calif., Oklahoma City, Okla., and Sault Ste. Marie, Mich., showed current pressures to be higher at all levels up to 4, 5, 6, and 9 kilometers, respectively, and lower than in 1938 at all levels above. At Washington, D. C., the current year and month showed lower pressures above 2 kilometers.

Mean relative humidity for November was generally high in the lower levels and, in some cases, continued into the upper levels. High humidity at all levels was noted over Sault Ste. Marie, Mich., Washington, D. C., Miami, Fla., Buffalo, N. Y., and Shreveport, La., while relative humidities were lowest over Oakland, Calif., San Diego, Calif., Bismarck, N. Dak., Medford, Oreg., and Oklahoma City, Okla. Juneau, Alaska, recorded the greatest percentage of mean relative humidities at all levels.

In the United States the temperatures at 1.5 kilometers (chart VIII) were lowest over Sault Ste. Marie, Mich., and highest over Miami, Fla., and San Diego, Calif. At this level the temperature over all of the country, except the Great Lakes region and New England, was above freezing (0° C.). However, at Fairbanks and Juneau, Alaska, the lowest temperatures were recorded (-12.6° C. and -4.5° C., respectively). Similar conditions prevailed at 3, 4, and 5 kilometers (charts IX, X, and XI, respectively), with the exception that Miami, Fla., became considerably warmer than San Diego, Calif., and freezing temperatures spread farther over the South.

Above 5 kilometers temperatures in the United States were lowest over Sault Ste. Marie, Mich., and highest over Miami, Fla. However, at 13 kilometers, both El Paso, Tex., and San Antonio, Tex., became colder than Sault Ste. Marie, Mich., while at 14 kilometers Miami, Fla., became colder than any station and continued so to the maximum altitude reached. The lowest mean temperature recorded during November (-72.3° C.) occurred at 17 kilometers over Miami, Fla. Both Alaskan stations became warmer than elsewhere at 12 kilometers and remained so throughout all higher levels.

Individual minimum temperatures were lowest over the southern stations (Miami, Fla., −77.8° C.; Charleston, S. C., −75.2° C.; El Paso, Tex., −74.3° C.; Atlanta, Ga., −74.2° C.; and San Antonio, Tex., −73.0° C.). All stations south of the 35th parallel, as well as Nashville, Tenn., and Oakland, Calif., recorded individual low temperatures colder than −70.0° C. The warmest minimum temperatures occurred over the Alaskan stations (Fairbanks and Juneau, −60.8° C.). Lowest temperatures recorded over Fairbanks, Alas., occurred at 9 kilometers; over Sault Ste. Marie, Mich., at 13 kilometers; and over St. Louis, Mo., Atlanta, Ga., and Miami, Fla., at 16 kilometers. Mean freezing temperatures (0° C.) occurred north of the Great Lakes area at the surface; as far south as Pennsylvania, lower Michigan, and Minnesota at the 1-kilometer level; over Maryland, the Ohio valley, Iowa, and North Dakota at 2 kilometers; over Georgia, Oklahoma, Wyoming, and Oregon at 3 kilometers; and over southern Florida at 4 kilometers.

In the United States and Alaska all radiosonde stations had lower temperatures during November than in the preceding month at all levels up to about 14 kilometers, and then warmer above. However, Billings, Mont., Bismarck, N. Dak., Joilet, Ill., Miami, Fla., Minneapolis, Minn., Phoenix, Ariz., and Sault Ste. Marie, Mich., were colder during the current month at all levels. At those stations where radiosonde observations have been made for a year the current month was colder than November 1938, at all levels over Nashville, Tenn., Sault Ste. Marie, Mich., and Washington, D. C. But Bismarck, N. Dak., and Oakland, Calif., were warmer than 1938 at all levels, while Oklahoma City, Okla., and Omaha, Nebr., were warmer only in the lower levels, and then colder above.

Considering the season of the year November pilot-balloon observations were quite satisfactory as high maximum altitudes were reached in many cases, and at all Weather Bureau stations in the United States balloon flights exceeded 5 kilometers. At 64, 23, 5, and 3 stations individual maximum altitudes in excess of 10, 15, 20, and 25 kilometers, respectively, were reached. Western stations, as well as those in the Southeast, reached altitudes higher than 10 kilometers. Most maximum elevations were reported on the 3d, 13th, 14th, and 28th of November.

The pilot-balloon work previously conducted at Cleveland, Ohio, was transferred to Akron, Ohio, beginning with November 1, 1939. Also, effective November 15, the hour of all pilot-balloon observations was changed to 5 a. m., 11 a. m., 5 p. m., and 11 p. m., 75th meridian time.

Resultant-wind directions and forces, based on 5 a. m., 75th meridian time observations made at 1.5 kilometers during November, are shown on chart VIII. Over the eastern two-thirds of the country the winds were from the northwest quadrant, but in the far West the directions were generally from the southwest. During the current month the wind directions were more northerly than in the preceding month, except in the far West and Northwest. Resultant velocities were moderate; the highest being confined to the East (Harrisburg, Pa., 10.7 meters per second). Low velocities occurred over the South, California and western Nevada (Sacramento, Calif., 0.1 meters per second).

At 1.5 kilometers the current winds deviated from normal directions by turning northward in clockwise rotations over the eastern and southern portions of the United States. But in the northwestern portion of the country the winds backed away from normal by turning in counterclockwise rotations so as to become more southerly than normal. Large clockwise departures occurred over Houston, Tex., Nashville, Tenn., Sault Ste. Marie, Mich., and San Diego, Calif. Resultant velocities were lighter than normal over most of the country, except in the far Northwest and the extreme East. Outstanding velocity departures were found over Seattle, Wash., where the current resultant was greater than normal (+4.5 meters per second), and at Nashville, Tenn., where it was lower (−4.8 meters per second).

The winds at 3 kilometers (chart IX) showed that northwesterly resultants predominated. However, along the Pacific coast the directions were westerly and southwesterly. The current directions were more northerly than those observed during October, except in the far Northwest where the November directions were more southerly. Resultant velocities for November were lowest in the far Southwest and over California. But elsewhere the wind velocities were higher than those noted at 1.5 kilometers. The highest velocity in November at 3 kilometers occurred over Richmond, Va., (11.3 meters per second.

November directions at the 3-kilometer level showed departures from normal that turned through clockwise rotations over all of the United States, except in the far Northwest. Large departures from normal occurred over Oklahoma City, Okla., San Diego, Calif., Medford, Oreg., and Spokane, Wash. The velocities were less than normal over the entire country, with the exception of the extreme Northwest. Outstanding negative departures from normal were noted over Albuquerque, N. Mex. (−5.0 meters per second), Cheyenne, Wyo. (−5.3 meters per second), Omaha, Nebr. (−4.1 meters per second), Nashville, Tenn. (−4.6 meters per second), and Boston, Mass. (−4.2 meters per second).

Chart X shows the resultant winds at 4 kilometers, based on 5 p. m., 75th meridian time observations. Northwesterly directions again predominated over most of the country While winds from the southwest quadrant persisted in the northern portion of the Pacific slope, northwesterly and northerly winds occurred over all but extreme southern California. Resultant velocities at 4 kilometers were unusually low in the extreme Southwest, and a resultant calm occurred at Winslow, Ariz. The highest velocities were noted over the Eastern States (Richmond, Va., 15.9 meters per second), and the Ohio Valley and lower Great Lakes region (Chicago, Ill., 14.2 meters per second).

At 4 kilometers the winds were more northerly than normal over the eastern half of the country, and more southerly over the western portion. Departures from normal were outstanding at Boston, Mass., Nashville, Tenn., Medford, Oreg., Seattle, Wash., Salt Lake City, Utah, and Spokane, Wash. Current resultant velocities were greater than normal over the eastern one-third of the United States and the far Northwest, but less than normal elsewhere (Chicago, Ill., +4.0 meters per second; Cincinnati, Ohio, +3.9 meters per second; Seattle, Wash., +3.0 meters per second; Cheyenne, Wyo., −3.7 meters

per second; and Salt Lake City, Utah, −4.6 meters per second).

Resultant-wind directions at 5 kilometers were northwesterly in practically all cases, except the extreme Southeast and far Northwest. Velocities were high east of the Mississippi Valley, being above 10 meters per second, in all but two cases. Richmond, Va., reported the highest velocity (18.2 meters per second). Low resultant velocities persisted, however, in the extreme Southwest, being only 0.3 meter per second at Winslow, Ariz.

The November wind directions at 5 kilometers departed from normal by backing in counterclockwise rotations over the Southeast and the Pacific coast. Elsewhere the wind directions departed from normal in clockwise rotations. Outstanding departures were noted at Spokane, Wash., Medford, Oreg., and Oakland, Calif. Extreme departures from the normal velocities were noted over Houston, Tex. (+4.4 meters per second), Medford, Oreg. (−3.0 meters per second), Albuquerque, N. Mex. (−5.4 meters per second), and Salt Lake City, Utah (−4.4 meters per second).

A study of wind directions and velocities at 1.5 kilometers, based on 5 a. m. (chart VIII) and 5 p. m. (table 2) observations, indicated a diurnal change in the afternoon directions from those noted at 5 a. m. This departure was clockwise over the South and Southeast, and the central and southern Pacific and Rocky Mountain areas, and counterclockwise elsewhere over the country. At Abilene, Tex., Atlanta, Ga., Little Rock, Ark., and Salt Lake City, Utah, the 5 p. m. winds were more northerly than at 5 a. m. by wide variations, but at Reno, Nev., Sault Ste. Marie, Mich., and Brownsville, Tex., they were decidedly more southerly. Afternoon velocities were higher in the extreme southwest and Southeast, and along the northern border; elsewhere they were lower, particularly the Ohio valley (Cincinnati, Ohio, −2.9 meters per second).

At 3 kilometers the 5 p. m. winds were more southerly than at 5 a. m. over most of the country with the exception of the Northeast and the Great Lakes region, the far Northwest and the extreme Southeast. The afternoon resultant velocities were higher than at 5 a. m. east of a line from El Paso, Tex., to Fargo, N. Dak., and lighter elsewhere. High velocity excesses in the afternoon over the 5 a. m. wind speeds occurred at Washington, D. C. (+3.7 meters per second), Nashville, Tenn. (+3.1 meters per second), and Omaha, Nebr. (+3.6 meters per second).

Table 2 lists resultant winds based on 5 p. m., 75th meridian time observations. Pilot-balloon flights in the East and Southeast show that the winds turned in counterclockwise rotations as the altitude increased. This was outstanding at Atlanta, Ga., and Charleston, S. C. Over the remainder of the United States the winds turned generally toward the north in clockwise rotations with altitude, particularly over the Great Lakes region and the Northwest. Elsewhere it was noted that as an altitude of 10 kilometers was gained the winds ceased to turn clockwise and began gradually to back in a counterclockwise rotation. At this level the maximum 5 p. m. resultant velocities were noted, and the greatest pressure gradient (by radiosonde observations) between the low- and high-pressure areas (Sault Ste. Marie, Mich., and Miami, Fla., with a gradient difference of 26 millibars) was found to occur.

Table 3 shows the maximum individual wind speeds observed during November. While the velocities were not unusually excessive, the speeds of 45.7 meters per second over Harrisburg, Pa., at 2,360 meters, and 75.2 meters per second over Abilene, Tex., were high for these stations.

MONTHLY MEAN ISENTROPIC CHART [1]

The mean isentropic chart, $\theta=302°$ (chart XII), for November 1939 is characterized by two weak anticyclonic eddies over the Southwest, both evidently off-shoots of the broad west-northwesterly current over the eastern half of the country. This strong current, which seems also to have a weak downslope motion, has effectively blocked the transport of moisture from the Gulf of Mexico, and is undoubtedly the cause of the almost general deficit in precipitation in the East. The large deficit in the Northwest, on the other hand, is located in a region of upslope motion; however, the air is unusually dry and probably this circumstance was the decisive factor in decreasing the precipitation.

[1] Prepared by the Division of Research and Education.

TABLE 1.—*Mean free-air barometric pressures (P.) in mb., temperatures (T.) in ° C., and relative humidities (R. H.) in percent obtained by airplanes [1] during November 1939*

Stations and elevations in meters above sea level	Altitude (meters) m. s. l.																												
	Surface				500			1,000			1,500			2,000			2,500			3,000			4,000			5,000			
	Number of obs.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.	P.	T.	R. H.
Coco Solo, C. Z. (15 m)	16	1,010	25.4	90	956	24.1	86	903	21.7	84	852	19.1	81	804	16.7	73	759	14.7	65	715	12.6	57	634	7.0	50				
Norfolk, Va. (10 m)	25	1,025	6.9	74	966	8.2	63	909	5.8	60	855	3.9	57	804	2.1	53	756	.3	50	709	−2.6	48	625	−10.0	47	548	−17.5	48
Pearl Harbor, T. H. (6 m)	30	1,015	21.7	81	960	19.7	76	905	15.9	81	854	13.0	77	804	12.2	57	757	10.4	39	713	7.9	34	631	1.7	27				
Pensacola, Fla. (13 m)	27	1,024	9.4	80	966	13.3	61	910	11.3	59	857	9.2	58	807	7.9	48	759	6.1	44	714	3.7	41	630	−2.4	46	555	−8.5	44
St. Thomas, V. I. (8 m)	16	1,014	27.0	78	959	23.7	92	906	20.9	85	854	18.5	74	805	16.4	66	759	13.9	67	716	11.5	61	634	6.1	61				
San Diego, Calif. (10 m)	28	1,015	15.0	75	959	17.5	56	904	16.5	40	852	13.5	36	803	10.4	33	755	7.2	30	710	4.3	27	628	−3.0	24				
Seattle, Wash. (10 m)	21	1,019	9.2	82	962	10.2	63	906	8.9	60	852	6.3	60	802	3.7	56	754	1.3	48	708	−0.9	40	624	−5.9	48				
LATE REPORT FOR OCTOBER 1939																													
St. Thomas, V. I. (8 m)	29	1,013	27.8	77	958	24.4	91	905	21.7	84	854	19.0	78	806	16.8	71	759	14.4	66	715	11.7	66	635	6.4	56				

[1] U. S. Navy

Observations taken about 1 a. m. 75th meridian time, except by Navy station along the Pacific coast and Hawaii where they are taken at dawn.
NOTE.—None of the means included in this table are based on less than 15 surface or 5 standard-level observations.

TABLE 1a.—*Mean free-air barometric pressures (P.) in mb., temperatures (T.) in ° C., and relative humidities (R. H.) in percent obtained by radiosondes during November 1939*

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,621 m.)				Atlanta, Ga. (298 m.)				Shreveport, La.[1] (51 m.)				Billings, Mont. (1,089 m.)				Bismarck, N. Dak. (508 m.)				Boise, Idaho (824 m.)				Buffalo, N. Y. (219 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	30	843	5.3	53	30	988	6.3	78	22	1,018	8.5	84	30	896	3.9	44	30	961	−1.8	70	30	928	−0.3	86	30	997	1.3	77
500					30	965	8.7	73	22	965	10.3	75													29	963	0.4	73
1,000					30	908	7.5	68	22	910	8.9	77					30	905	4.8	54	30	908	5.0	71	29	904	−1.7	71
1,500					30	854	5.6	62	22	856	7.3	75	30	852	8.5	41	30	851	3.3	48	30	854	6.2	55	29	849	−2.6	61
2,000	30	805	6.6	51	30	803	3.2	55	21	805	5.9	67	30	802	6.3	39	30	800	2.0	43	30	803	4.0	51	29	796	−3.9	54
2,500	29	757	3.7	52	30	755	0.8	52	21	757	4.0	64	30	754	2.8	38	30	751	−0.2	38	30	755	1.5	45	29	747	−5.9	50
3,000	29	712	0.8	50	30	709	−1.7	48	19	712	2.3	61	30	708	−0.6	38	29	705	−2.7	34	30	709	−1.6	43	29	701	−8.3	50
4,000	29	628	−4.1	44	30	625	−7.0	42	18	630	−1.9	56	30	624	−6.6	38	29	621	−9.0	31	30	625	−7.6	43	29	615	−14.1	50
5,000	29	552	−10.7	40	30	549	−12.9	44	17	554	−7.4	52	30	549	−13.3	38	29	545	−15.5	29	30	549	−13.8	42	27	538	−20.2	46
6,000	29	484	−18.6	39	29	481	−19.4	43	15	485	−13.0	50	30	480	−20.6	38	29	476	−22.6	27	30	480	−21.5	41	27	470	−27.6	45
7,000	29	422	−26.4	38	29	420	−26.9	42	11	425	−19.7	52	30	419	−28.5	38	28	414	−31.0	27	30	418	−29.8	40	27	408	−35.3	44
8,000	30	367	−34.4	37	29	365	−34.5	43	9	371	−25.5	51	30	363	−37.0	37	28	359	−39.0	28	30	363	−38.0	40	26	352	−42.2	----
9,000	30	317	−42.1	35	29	315	−41.1	----	6	324	−32.2	48	30	314	−45.3	----	28	309	−46.8	----	30	313	−45.8	40	27	303	−48.8	----
10,000	30	273	−48.8	----	29	272	−47.5	----	----	----	----	----	30	269	−52.5	----	28	265	−53.4	----	30	269	−53.2	----	27	260	−54.4	----
11,000	29	234	−53.8	----	29	233	−53.0	----	----	----	----	----	30	230	−58.6	----	27	227	−58.1	----	30	230	−58.9	----	27	222	−56.8	----
12,000	28	200	−57.5	----	29	199	−57.3	----	----	----	----	----	30	196	−61.4	----	27	193	−60.2	----	30	196	−61.4	----	27	189	−58.1	----
13,000	27	171	−60.2	----	29	170	−61.1	----	----	----	----	----	30	167	−61.3	----	26	164	−60.0	----	30	167	−62.5	----	25	161	−59.2	----
14,000	25	145	−62.6	----	29	144	−63.9	----	----	----	----	----	30	142	−60.9	----	24	140	−60.1	----	29	142	−62.4	----	23	137	−60.3	----
15,000	25	123	−64.2	----	27	123	−66.2	----	----	----	----	----	30	121	−61.5	----	23	119	−60.4	----	29	120	−62.9	----	22	116	−61.6	----
16,000	25	104	−65.4	----	27	104	−67.9	----	----	----	----	----	26	103	−61.3	----	21	102	−59.8	----	29	102	−62.6	----	21	99	−61.9	----
17,000	18	89	−65.5	----	25	88	−67.7	----	----	----	----	----	24	88	−61.0	----	18	86	−59.1	----	27	87	−62.0	----	17	84	−61.8	----
18,000	10	76	−65.0	----	19	75	−66.1	----	----	----	----	----	14	75	−60.4	----	11	74	−57.9	----	23	74	−61.0	----	8	71	−61.8	----
19,000	----	----	----	----	7	63	−63.9	----	----	----	----	----	8	63	−59.8	----	----	----	----	----	19	63	−59.6	----	----	----	----	----
20,000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	7	54	−58.7	----	----	----	----	----

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Charleston, S. C. (14 m.)				Denver, Colo. (1616 m.)				El Paso, Tex. (1194 m.)				Ely Nev. (1909 m.)				Fairbanks, Alaska (152 m.)				Joliet, Ill. (178 m.)				Juneau, Alaska (49 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	30	1,021	6.5	86	30	843	0.1	60	30	887	7.4	65	30	814	−1.9	61	29	987	−17.7	68	29	1,003	1.0	87	30	1,000	3.6	82
500	30	963	10.6	63													29	944	−16.6	72	29	964	3.2	69	30	946	1.7	82
1,000	30	907	9.0	57													29	883	−13.8	72	29	906	1.6	62	30	889	−1.6	84
1,500	30	854	7.0	55					30	856	9.3	59					29	827	−12.6	70	29	852	0.3	55	30	834	−4.5	85
2,000	30	803	5.3	49	30	804	6.2	52	30	804	7.1	59	30	805	1.3	58	29	774	−13.3	68	29	799	−2.1	52	29	783	−7.2	84
2,500	30	755	3.0	45	30	757	4.4	46	30	757	4.2	60	30	757	4.0	47	29	725	−16.0	66	29	750	−4.5	50	29	734	−10.2	82
3,000	30	710	0.5	40	30	711	1.1	44	30	712	1.7	60	30	711	1.3	44	29	678	−18.8	63	29	704	−6.9	49	28	687	−13.2	79
4,000	29	626	−4.8	34	30	627	−5.4	43	30	628	−3.6	52	30	627	−5.1	41	29	592	−25.5	63	29	619	−12.2	45	24	601	−19.5	76
5,000	29	551	−10.6	33	30	552	−11.8	44	30	553	−10.0	44	29	552	−11.6	35	27	514	−32.6	60	29	542	−18.6	41	21	525	−26.3	73
6,000	29	483	−17.3	33	30	483	−19.3	42	30	485	−17.2	40	28	483	−19.0	32	27	445	−39.8	58	29	473	−25.9	39	19	456	−33.0	73
7,000	29	422	−24.0	33	30	422	−27.0	41	30	423	−24.7	37	26	422	−27.1	32	27	384	−47.0	----	29	411	−33.7	39	15	394	−41.5	----
8,000	29	366	−31.6	32	30	366	−35.1	40	30	368	−31.8	36	26	366	−35.6	32	27	329	−52.7	----	29	356	−40.9	----	13	339	−48.2	----
9,000	29	318	−38.7	32	30	316	−43.5	----	30	319	−38.9	36	26	316	−43.5	----	27	282	−55.1	----	29	306	−47.8	----	12	290	−52.5	----
10,000	29	274	−45.3	----	30	272	−50.8	----	30	275	−46.0	----	26	272	−51.1	----	25	241	−53.3	----	28	262	−53.0	----	11	248	−53.3	----
11,000	28	235	−51.3	----	29	233	−56.2	----	30	236	−53.0	----	26	233	−57.1	----	24	207	−51.3	----	28	225	−55.7	----	9	213	−51.2	----
12,000	27	202	−56.2	----	28	199	−59.2	----	30	202	−58.4	----	25	198	−60.2	----	24	177	−50.7	----	26	192	−57.4	----	7	182	−49.8	----
13,000	26	172	−60.4	----	28	169	−60.9	----	30	172	−61.4	----	25	169	−61.1	----	22	151	−50.9	----	25	164	−58.5	----	7	156	−49.6	----
14,000	24	146	−63.8	----	26	144	−61.7	----	29	146	−64.4	----	23	144	−61.6	----	20	130	−51.0	----	24	139	−60.0	----	7	134	−49.7	----
15,000	23	124	−66.6	----	26	123	−62.7	----	29	124	−67.0	----	22	122	−62.8	----	15	172	−51.0	----	20	118	−60.8	----	6	115	−49.6	----
16,000	21	105	−68.3	----	24	104	−63.5	----	28	105	−68.4	----	21	104	−63.5	----	13	95	−51.0	----	18	101	−61.2	----	----	----	----	----
17,000	16	89	−68.7	----	20	89	−63.2	----	25	89	−68.0	----	16	88	−63.2	----	8	81	−51.1	----	14	86	−61.0	----	----	----	----	----
18,000	14	75	−66.8	----	15	76	−62.7	----	22	75	−66.4	----	11	75	−62.4	----	----	----	----	----	6	73	−60.9	----	----	----	----	----
19,000	11	64	−65.2	----	----	----	----	----	12	64	−65.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
20,000	7	54	−63.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Stations and elevations in meters above sea leve

Altitude (meters) m. s. l.	Lakehurst, N. J.[2] (39 m.)				Medford, Oreg. (401 m.)				Miami, Fla. (4 m.)				Minneapolis, Minn. (263 m.)				Nashville, Tenn. (180 m.)				Oakland, Calif. (2 m.)				Oklahoma City, Okla. (391 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	28	1,017	2.6	73	29	974	4.4	83	29	1,017	18.2	87	30	992	0.6	70	29	1,003	4.2	78	29	1,019	8.9	82	30	979	6.6	71
500	28	961	2.3	61	29	962	5.9	78	29	961	18.1	77	30	963	3.0	66	29	965	6.4	68	29	960	13.7	58	30	965	8.1	66
1,000	28	904	0.5	62	29	905	9.2	56	29	906	15.0	78	30	906	2.4	59	29	908	4.6	62	29	905	12.8	44	30	909	7.3	59
1,500	27	849	−0.2	55	29	852	8.4	48	29	854	12.2	73	30	851	0.6	52	29	854	3.2	55	29	853	10.5	36	30	855	5.3	56
2,000	27	798	−1.7	54	29	802	5.6	47	29	804	11.0	65	30	800	−1.5	48	29	802	1.3	50	29	803	8.4	31	30	804	3.1	53
2,500	27	749	−3.2	55	29	754	3.0	42	29	757	9.5	54	30	751	−4.2	49	29	754	−0.8	49	29	755	5.8	28	30	756	1.6	47
3,000	27	703	−5.8	54	29	708	0.6	37	29	713	7.2	45	30	704	−6.3	47	29	708	−3.4	49	29	710	2.8	25	30	710	−0.5	44
4,000	27	618	−10.9	59	29	625	−5.9	36	29	631	2.0	39	30	619	−11.7	46	29	623	−8.9	48	29	627	−3.7	25	30	626	−6.1	40
5,000	27	542	−17.0	63	29	549	−12.1	33	29	557	−3.9	33	30	543	−18.1	45	28	547	−15.0	47	29	551	−10.3	24	29	550	−12.2	36
6,000	26	473	−23.9	67	29	481	−19.3	32	29	490	−9.5	34	30	474	−25.5	44	28	478	−21.4	44	29	483	−17.5	23	28	481	−19.0	34
7,000	26	411	−31.2	66	28	420	−27.3	32	29	430	−15.7	32	30	412	−33.6	43	28	417	−28.3	42	29	422	−25.5	22	28	420	−26.4	35
8,000	23	357	−39.1	----	28	364	−35.5	31	29	376	−22.7	31	30	356	−41.5	----	27	362	−35.7	42	29	367	−33.9	22	28	365	−34.0	34
9,000	22	308	−46.2	----	28	314	−43.2	----	29	327	−30.5	30	30	307	−48.6	----	26	313	−42.5	----	29	317	−42.2	22	28	315	−41.8	----
10,000	20	264	−51.6	----	28	270	−51.0	----	28	284	−38.2	28	30	263	−54.2	----	26	269	−48.2	----	29	273	−50.1	----	28	271	−49.0	----
11,000	17	226	−54.9	----	27	231	−57.7	----	28	245	−45.8	----	30	225	−57.6	----	25	231	−52.6	----	29	234	−56.8	----	28	232	−54.4	----
12,000	16	193	−56.7	----	26	197	−61.7	----	27	210	−53.0	----	29	192	−58.7	----	20	198	−56.5	----	29	199	−60.8	----	28	198	−58.5	----
13,000	15	165	−58.1	----	20	168	−62.6	----	26	179	−59.8	----	29	164	−58.6	----	17	169	−60.0	----	29	170	−62.4	----	27	169	−60.9	----
14,000	11	141	−59.8	----	19	143	−62.6	----	26	152	−65.5	----	28	139	−59.4	----	16	144	−62.1	----	28	144	−63.1	----	26	144	−62.7	----
15,000	6	120	−61.1	----	16	122	−63.4	----	26	129	−69.9	----	28	119	−59.8	----	14	122	−64.0	----	28	123	−64.0	----	25	122	−64.2	----
16,000	5	102	−61.9	----	15	104	−63.2	----	25	109	−72.2	----	24	101	−60.2	----	13	104	−65.4	----	27	104	−65.3	----	24	104	−65.1	----
17,000	----	----	----	----	13	88	−62.4	----	25	92	−72.3	----	18	86	−60.2	----	12	88	−65.7	----	24	88	−65.2	----	23	88	−65.0	----
18,000	----	----	----	----	8	75	−61.0	----	24	78	−71.6	----	10	73	−59.8	----	10	75	−65.0	----	23	75	−64.1	----	17	74	−64.0	----
19,000	----	----	----	----	----	----	----	----	18	66	−69.4	----	----	----	----	----	8	64	−63.4	----	18	64	−62.6	----	6	63	−62.6	----
20,000	----	----	----	----	----	----	----	----	13	55	−65.6	----	----	----	----	----	----	----	----	----	8	54	−61.5	----	----	----	----	----
21,000	----	----	----	----	----	----	----	----	5	47	−63.4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

[1] U. S. Army, Barksdale Field.

[2] U. S. Navy.

TABLE 1a.—*Mean free-air barometric pressures (P.) in mb., temperatures (T.) in ° C., and relative humidities (R. H.) in percent obtained by radiosondes during November 1939*—Continued

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level																							
	Omaha, Nebr. (300 m.)				Phoenix, Ariz. (339 m.)				St. Louis, Mo. (176 m.)				San Antonio, Tex. (174 m.)				Sault Ste. Marie, Mich. (221 m.)				Spokane, Wash. (597 m.)				Washington, D. C.[1] (7 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	30	989	2.7	66	29	977	13.4	61	30	1,005	4.9	71	29	1,004	11.6	71	30	995	−1.2	85	30	952	1.9	88	27	1,022	4.5	75
500	30	935	5.1	61	29	960	17.2	57	30	966	6.1	62	29	965	13.2	69	30	961	−1.9	86					27	962	4.2	57
1,000	30	908	5.2	53	29	905	16.8	49	30	908	4.1	60	29	910	11.0	71	30	902	−2.9	78	30	906	5.8	70	27	905	2.7	55
1,500	30	854	3.0	50	29	853	13.4	47	30	854	2.3	57	29	857	8.8	68	30	847	−3.2	65	30	852	5.3	60	27	851	1.5	51
2,000	30	802	1.1	46	29	803	9.6	48	30	802	0.5	54	29	806	6.9	64	30	795	−4.6	59	30	801	2.9	57	27	799	0.0	49
2,500	30	754	−1.3	42	29	756	6.4	49	30	754	−1.8	53	29	758	4.9	62	30	746	−6.8	57	30	753	0.2	57	27	750	−2.2	48
3,000	30	708	−3.9	41	29	711	3.4	48	30	708	−4.5	52	29	713	2.8	58	30	699	−9.1	57	30	707	−2.7	58	27	705	−4.3	49
4,000	30	623	−9.3	36	29	628	−3.0	44	30	623	−10.1	53	29	630	−1.3	48	30	614	−14.6	56	30	623	−8.5	55	27	620	−9.8	56
5,000	30	547	−15.9	36	28	552	−9.9	40	29	546	−16.6	50	29	555	−7.0	46	30	537	−21.1	56	28	547	−14.8	49	27	544	−15.8	56
6,000	30	478	−23.3	35	28	484	−17.7	40	29	477	−23.6	46	29	487	−13.4	45	30	469	−28.5	58	28	478	−21.7	46	26	476	−22.6	54
7,000	30	416	−30.8	35	28	423	−25.6	40	29	415	−31.8	43	29	426	−20.9	43	29	406	−36.3	57	28	416	−29.5	45	24	414	−29.7	56
8,000	30	360	−39.4	----	28	368	−33.4	40	29	359	−39.4	40	29	372	−28.2	43	28	351	−43.8	----	28	361	−37.5	45	19	359	−37.4	60
9,000	30	311	−46.8	----	28	318	−41.0	39	28	310	−46.5	----	29	322	−35.9	43	28	302	−51.0	----	28	312	−45.6	----	17	310	−44.7	----
10,000	30	267	−52.9	----	28	274	−48.0	----	28	266	−51.7	----	29	279	−43.2	----	24	258	−56.9	----	28	267	−53.2	----	16	267	−50.2	----
11,000	30	228	−56.4	----	28	235	−53.7	----	26	228	−55.7	----	29	240	−50.4	----	23	220	−59.6	----	28	229	−58.8	----	13	229	−54.7	----
12,000	29	194	−58.2	----	28	201	−57.8	----	26	194	−58.5	----	29	205	−56.9	----	21	188	−60.5	----	27	195	−61.7	----	11	195	−58.0	----
13,000	28	166	−59.2	----	28	171	−60.3	----	24	166	−59.6	----	29	175	−61.4	----	20	160	−60.5	----	27	166	−61.6	----	9	167	−60.1	----
14,000	26	141	−60.3	----	27	146	−62.3	----	23	141	−61.1	----	28	149	−64.5	----	16	136	−60.5	----	26	141	−60.9	----	9	142	−61.6	----
15,000	26	120	−61.5	----	27	124	−64.5	----	20	120	−62.4	----	26	126	−66.8	----	12	116	−60.6	----	25	120	−60.9	----	----	----	----	----
16,000	20	102	−62.0	----	24	105	−66.0	----	18	102	−62.9	----	25	107	−68.2	----	8	98	−61.2	----	23	103	−61.0	----	----	----	----	----
17,000	9	87	−61.6	----	22	89	−66.6	----	10	87	−62.7	----	24	91	−68.6	----	----	----	----	----	22	87	−60.2	----	----	----	----	----
18,000	----	----	----	----	19	75	−65.6	----	----	----	----	----	19	76	−67.9	----	----	----	----	----	13	74	−59.0	----	----	----	----	----
19,000	----	----	----	----	16	64	−64.4	----	----	----	----	----	11	65	−66.5	----	----	----	----	----	6	64	−57.9	----	----	----	----	----
20,000	----	----	----	----	6	54	−63.3	----	----	----	----	----	7	55	−64.7	----	----	----	----	----	----	----	----	----	----	----	----	----

[1] U. S. Navy.

Observations taken about 1 a. m. 75th meridian time, except by Navy stations along the Pacific coast and Hawaii where they are taken at dawn.

NOTE.—None of the means included in this table are based on less than 15 surface or 5 standard-level observations.

Number of observations refers to pressure only as temperature and humidity data are missing for some observations at certain levels, also, the humidity data are not used in daily observations when the temperature is below −40° C.

LATE REPORT FOR JULY 1939

Altitude (meters) m. s.l.	San Antonio, Tex. (174 m.)			
	Number of obs.	P.	T.	R. H.
Surface	24	995	25.2	78
500	24	958	24.5	79
1,000	24	906	23.4	65
1,500	24	855	21.7	58
2,000	24	806	19.0	56
2,500	24	761	15.9	54
3,000	24	718	12.8	53
4,000	24	637	6.8	50
5,000	24	563	0.8	47
6,000	24	497	−4.7	43
7,000	24	438	−10.9	41
8,000	24	383	−17.7	39
9,000	24	334	−24.7	38

Altitude (meters) m. s.l.	San Antonio, Tex. (174 m.)			
	Number of obs.	P.	T.	R. H.
10,000	23	291	−32.3	37
11,000	23	252	−39.8	----
12,000	23	218	−47.3	----
13,000	23	187	−54.5	----
14,000	23	160	−60.9	----
15,000	23	136	−66.3	----
16,000	23	115	−69.8	----
17,000	22	97	−70.4	----
18,000	22	82	−68.7	----
19,000	21	69	−66.0	----
20,000	17	59	−63.3	----
21,000	11	50	−60.8	----

TABLE 2.—*Free-air resultant winds based on pilot-balloon observations made near 5 p. m. (E. S. T.) during November 1939*

[Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—Velocities in meters per second (superior figures indicate number of observations]

Altitude (meters) m. s. l.	Abilene, Tex. (537 m.)		Albuquerque, N. Mex. (1,554 m.)		Atlanta, Ga. (302 m.)		Billings, Mont. (1,095 m.)		Boise, Idaho (850 m.)		Brooklyn, N. Y. (15 m.)		Brownsville, Tex. (7 m.)		Buffalo, N. Y. (220 m.)		Burlington, Vt. (132 m.)		Charleston, S. C. (18 m.)		Cheyenne, Wyo. (1,873 m.)		Chicago, Ill. (192 m.)		Cincinnati, Ohio (157 m.)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	314^{28}	0.6	201^{26}	0.7	303^{28}	1.0	255^{29}	3.4	282^{29}	1.4	310^{28}	4.8	53^{29}	2.4	264^{28}	2.2	309^{28}	1.6	354^{28}	1.6	277^{26}	1.7	267^{28}	2.6	295^{28}	1.7
500					302^{26}	1.0					309^{29}	5.3	51^{29}	2.9	266^{28}	2.8	296^{28}	4.6	342^{26}	2.9			270^{28}	3.7	292^{28}	2.6
1,000	57^{26}	0.2			308^{26}	2.0			289^{28}	1.2	312^{29}	5.5	41^{27}	2.0	273^{28}	5.9	292^{26}	6.3	336^{27}	3.2			282^{26}	6.6	297^{21}	3.0
1,500	283^{26}	0.7			323^{27}	3.0	261^{29}	5.7	154^{28}	1.2	312^{28}	6.5	27^{28}	0.3	283^{24}	7.0	292^{28}	7.1	323^{25}	4.0			287^{23}	9.2	315^{21}	4.6
2,000	285^{26}	2.4	168^{26}	1.0	297^{25}	3.8	274^{29}	6.6	179^{29}	1.1	322^{28}	8.0	242^{23}	0.4	292^{20}	7.5	307^{12}	8.0	305^{23}	5.5	279^{29}	2.3	287^{26}	9.3	310^{19}	6.3
2,500	283^{26}	3.9	146^{26}	1.3	283^{24}	5.8	282^{29}	7.4	243^{26}	2.8	314^{26}	9.5	266^{16}	2.5	317^{13}	4.5	305^{12}	9.0	301^{22}	6.7	292^{29}	3.4	296^{19}	9.5	308^{19}	8.5
3,000	279^{26}	5.2	224^{27}	0.5	285^{23}	7.1	282^{29}	8.4	235^{25}	2.7	302^{23}	10.9	287^{14}	3.3	337^{10}	2.6	323^{10}	8.2	283^{19}	7.6	294^{29}	5.0	299^{19}	10.0	306^{16}	11.3
4,000	293^{26}	6.4	263^{23}	1.3	287^{16}	9.8	289^{23}	8.6	251^{22}	3.3	305^{19}	10.4	279^{11}	7.3					278^{14}	7.4	301^{27}	6.3	309^{16}	14.2	306^{12}	12.1
5,000	297^{19}	7.2	311^{20}	3.0	276^{13}	12.5	296^{19}	10.2	280^{13}	5.0									275^{13}	8.6	308^{26}	7.1				
6,000	284^{17}	8.5	314^{20}	4.7	280^{17}	14.6	298^{16}	8.8													313^{26}	7.7				
8,000	284^{13}	17.5	311^{19}	5.4	276^{13}	22.0	320^{13}	7.5													341^{21}	8.3				
10,000			290^{17}	10.4	277^{14}	30.2	351^{17}	7.0													339^{20}	9.4				
12,000			276^{14}	17.3	267^{13}	36.8															304^{14}	9.2				
14,000																					295^{10}	8.9				

TABLE 2.—*Free-air resultant winds based on pilot-balloon observations made near 5 p. m. (E. S. T.) during November 1939*—Continued

Altitude (meters) m. s. l.	El Paso, Tex. (1,196 m.)		Fargo, N. Dak. (283 m.)		Greensboro, N. Car. (271 m.)		Havre, Mont. (766 m.)		Houston, Tex. (21 m.)		Huron, S. Dak. (393 m.)		Las Vegas, Nev. (570 m.)		Little Rock, Ark. (82 m.)		Medford Oreg. (410 m.)		Miami, Fla. (10 m.)		Minneapolis, Minn. (261 m.)		Nashville, Tenn. (194 m.)		New Orleans, La. (19 m.)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Surface	66^{20}	1.6	216^{30}	2.5	320^{28}	0.9	260^{20}	3.7	33^{29}	1.5	199^{20}	1.8	74^{25}	0.6	10^{29}	1.3	10^{20}	0.1	38^{20}	3.5	245^{30}	1.3	1^{29}	1.6	14^{29}	2.4
500			229^{30}	3.1	333^{28}	1.8	252^{26}	6.8	63^{26}	1.4	204^{30}	1.8			16^{28}	2.6	343^{30}	.2	41^{30}	7.3	241^{30}	2.2	342^{28}	1.3	55^{29}	2.2
1,000			246^{29}	5.1	298^{28}	3.1	257^{26}	10.1	41^{28}	.5	248^{29}	3.6	51^{30}	2.4	25^{30}	2.9	137^{30}	1.8	48^{29}	7.0	266^{28}	4.0	342^{29}	1.1	19^{28}	2.2
1,500	85^{30}	2.4	269^{29}	6.0	316^{28}	4.4	271^{26}	11.2	333^{21}	3.2	274^{27}	5.8	49^{30}	2.6	343^{25}	1.3	174^{30}	2.6	43^{28}	4.8	277^{28}	5.9	290^{28}	2.2	355^{24}	1.5
2,000	115^{30}	2.4	272^{26}	7.3	305^{28}	6.8	283^{26}	10.6	312^{21}	4.3	285^{27}	7.1	60^{30}	1.3	309^{24}	1.7	200^{29}	3.0	38^{28}	2.6	275^{28}	7.3	288^{28}	4.9	313^{21}	3.4
2,500	176^{28}	1.5	276^{28}	7.0	295^{28}	8.1	281^{26}	9.6	307^{18}	6.6	287^{27}	7.6	65^{30}	1.3	295^{22}	3.9	227^{29}	3.7	296^{16}	2.9	285^{28}	7.0	299^{21}	6.2	300^{19}	5.6
3,000	186^{28}	1.2	285^{28}	8.0	299^{19}	10.6	275^{21}	8.2	301^{17}	7.5	290^{27}	7.7	71^{30}	1.0	301^{20}	5.8	252^{28}	4.0	297^{14}	6.3	293^{22}	8.6	297^{19}	7.6	291^{18}	7.0
4,000	251^{30}	2.7	280^{28}	9.1	287^{18}	11.9	288^{16}	8.2	298^{16}	9.6	297^{27}	9.2	297^{28}	1.7	302^{17}	10.4	252^{28}	5.4	274^{11}	9.0	303^{28}	8.4	297^{17}	9.1		
5,000	290^{27}	4.1	295^{28}	8.6	292^{16}	15.3			292^{13}	11.5	298^{27}	11.1	317^{27}	2.3	299^{12}	14.2	249^{28}	7.3	274^{11}	14.6	308^{17}	10.2	292^{16}	11.0		
6,000	282^{16}	6.0	308^{16}	9.1	291^{16}	16.6			293^{11}	14.3	304^{26}	12.0	351^{28}	3.4			258^{28}	6.5			323^{28}	8.2				
8,000	275^{13}	16.5	311^{15}	15.3	296^{16}	21.0					320^{25}	12.9	353^{24}	3.7			250^{19}	9.1								
10,000			309^{12}	10.6							320^{21}	14.6	332^{23}	7.5												
12,000			289^{10}	13.1							294^{17}	13.6	304^{23}	11.1												
14,000											293^{12}	13.3	281^{19}	12.6												
16,000													272^{16}	11.9												
18,000													265^{12}	8.9												

Altitude (meters) m. s. l.	Oakland, Calif. (8 m.)		Oklahoma City, Okla. (402 m.)		Omaha, Nebr. (306 m.)		Reno, Nev. (1,346 m.)		St. Louis, Mo. (170 m.)		Salt Lake City, Utah (1,294 m.)		San Diego, Calif. (15 m.)		San Juan, P. R. (16 m.)		Sault Ste. Marie, Mich. (198 m.)		Seattle, Wash. (14 m.)		Spokane, Wash. (603 m.)		Washington, D. C. (10 m.)		Winslow, Ariz. (1,488 m.)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	254^{30}	2.6	32^{27}	1.6	251^{29}	1.4	353^{29}	0.5	281^{28}	1.1	309^{29}	1.7	288^{29}	3.1	81^{30}	4.5	281^{27}	1.9	204^{28}	2.8	196^{29}	1.1	305^{29}	2.1	30^{28}	1.1
500	19^{30}	2.1	35^{27}	1.3	260^{29}	1.3			295^{28}	1.7			303^{29}	1.6	93^{29}	5.6	291^{27}	2.8	191^{25}	5.3			301^{29}	3.4		
1,000	17^{30}	1.3	8^{27}	0.9	271^{29}	2.7			263^{27}	3.2			112^{27}	1.5	103^{29}	4.1	280^{21}	3.7	191^{22}	8.0	197^{29}	2.3	303^{28}	5.2		
1,500	312^{29}	0.8	331^{27}	1.3	282^{28}	4.8	42^{29}	0.4	278^{24}	4.5	305^{26}	1.7	93^{26}	2.7	122^{25}	2.8	293^{18}	3.8	192^{21}	7.9	215^{28}	5.7	301^{26}	8.8		
2,000	276^{28}	0.3	288^{26}	2.9	282^{27}	6.6	158^{26}	1.7	280^{22}	6.9	269^{26}	1.0	85^{26}	3.0	110^{23}	2.8	294^{12}	4.5	198^{19}	7.8	234^{28}	7.3	301^{25}	10.4	65^{29}	1.9
2,500	328^{30}	1.0	291^{25}	4.2	294^{24}	8.1	200^{26}	2.0	291^{19}	8.4	239^{25}	1.5	75^{24}	2.8	120^{21}	2.5	298^{11}	5.3	207^{16}	7.8	239^{26}	7.5	296^{22}	11.2	116^{28}	1.4
3,000	338^{31}	2.0	291^{23}	6.4	298^{24}	9.2	228^{29}	2.3	296^{16}	10.4	242^{29}	1.8	53^{22}	0.4	111^{19}	2.8	309^{16}	7.1	220^{15}	8.1	240^{24}	9.0	291^{22}	12.4	153^{27}	1.4
4,000	313^{27}	2.2	306^{22}	8.1	306^{22}	9.7	264^{26}	2.9	307^{11}	11.0	251^{29}	2.7	275^{19}	2.1	110^{16}	1.7			221^{12}	9.4	256^{20}	9.3	292^{16}	12.9	0^{23}	0
5,000	274^{23}	2.2	317^{20}	9.8	306^{17}	11.1	284^{26}	3.5			284^{26}	3.4	288^{15}	6.1	211^{11}	0.7					257^{15}	9.5			193^{25}	0.3
6,000	280^{19}	4.0	315^{19}	12.6	313^{21}	14.2	290^{27}	4.1			303^{21}	3.6	292^{21}	10.6											324^{23}	1.8
8,000			305^{17}	15.5	314^{19}	17.9	283^{24}	5.1			321^{14}	6.5													311^{23}	4.0
10,000			292^{14}	17.5	312^{16}	18.2	288^{19}	8.7																	296^{19}	7.6
12,000					291^{13}	18.9	290^{13}	11.1																	280^{16}	12.4
14,000					278^{12}	14.7																			280^{16}	13.9
16,000					282^{10}	13.2																			275^{16}	10.6

TABLE 3.—*Maximum free air wind velocities (M. P. S.), for different sections of the United States based on pilot-balloon observations during November 1939*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station
Northeast [1]	45.7	NW	2,360	9	Harrisburg, Pa.	45.2	NNW	4,990	14	Buffalo, N. Y.	55.0	E	6,180	20	Akron, Ohio
East Central [2]	37.6	SW	1,690	10	Cincinnati, Ohio	45.8	NW	4,570	8	Louisville, Ky.	60.0	W	11,640	16	Greensboro, N. C
Southeast [3]	24.2	NE	810	3	Key West, Fla.	40.4	W	4,950	24	Atlanta, Ga.	68.2	W	13,500	13	Atlanta, Ga.
North Central [4]	41.5	S	1,590	26	Rapid City, S. Dak.	41.6	NW	5,000	7	Huron, S. Dak.	66.4	WSW	21,030	27	Rapid City, S. Dak.
Central [5]	41.3	SW	1,240	10	Indianapolis, Ind.	48.8	NW	5,000	8	Indianapolis, Ind.	64.0	WSW	10,400	10	Wichita, Kans
South Central [6]	28.9	SSW	1,390	9	Oklahoma City, Okla.	31.4	NW	5,000	24	Oklahoma City, Okla.	75.2	WNW	12,750	5	Abilene, Tex.
North east [7]	45.2	W	1,940	10	Havre, Mont.	43.5	W	3,950	10	Butte, Mont.	44.0	NW	7,700	9	Billings, Mont.
West Central [8]	22.7	NNE	760	28	Oakland, Calif.	33.7	WNW	3,220	7	Cheyenne, Wyo.	58.5	NNW	11,030	27	Redding, Calif.
Southwest [9]	21.7	WSW	2,370	9	El Paso, Tex.	49.0	S	4,800	5	Las Vegas, Nev.	52.0	WNW	12,160	4	Albuquerque, N. Mex.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, northern Nevada, and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

TABLE 4.—*Mean altitudes and temperatures of significant points identifiable as tropopauses during November 1939, classified according to the potential temperatures (10-degree intervals between 290° and 409° A.) with which they are identified. (Based on radiosonde observations)*

Potential temperatures, ° A	Albuquerque, N. Mex.			Atlanta, Ga.			Billings, Mont.			Bismarck, N. Dak.			Boise, Idaho			Buffalo, N. Y.			Charleston, S. C.		
	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature
			°C.			°C.			°C.			°C.			°C.			°C.			°C.
290–299																2	6.0	−35.3			
300–309	1	8.2	−45.0	1	7.8	−41.0				5	7.3	−39.4	3	7.4	−38.3	18	7.3	−40.1			
310–319	15	8.6	−42.2	10	8.0	−39.0	18	9.2	−49.4	27	9.2	−50.5	27	9.2	−49.5	24	9.3	−52.5	11	8.1	−38.4
320–329	31	10.0	−50.0	25	9.8	−48.6	38	10.7	−57.3	32	10.5	−56.9	35	10.9	−58.3	27	10.5	−57.0	15	9.3	−41.9
330–339	15	11.7	−58.4	20	11.3	−55.8	13	12.3	−64.6	12	11.7	−62.6	19	11.9	−63.4	11	11.5	−61.2	21	11.2	−53.0
340–349	8	12.2	−59.6	14	12.3	−59.7	4	12.6	−65.8	5	12.5	−63.2	5	12.5	−64.6	3	12.3	−61.7	12	12.3	−58.8
350–359	7	13.0	−60.9	8	12.9	−59.8	4	13.2	−63.8	2	13.0	−61.5	6	13.1	−63.5	1	13.6	−66.0	8	13.6	−65.0
360–369	7	13.9	−63.1	13	14.1	−65.5	1	13.4	−59.0	1	13.5	−61.0	2	13.6	−61.5	1	13.7	−64.0	4	14.7	−70.0
370–379	6	14.8	−65.3	5	14.7	−65.4	1	13.6	−57.0	1	13.9	−62.0	1	14.5	−65.0	3	14.4	−64.0	7	14.7	−66.4
380–389	7	15.5	−67.0	6	15.5	−68.0							2	15.1	−65.0	2	15.3	−67.5	7	16.0	−70.6
390–399	7	15.9	−66.0	5	16.3	−69.2							2	15.9	−67.5	1	15.3	−61.0	2	16.3	−68.5
400–409	3	16.4	−66.7	7	16.5	−68.3	1	15.8	−61.0				3	15.9	−64.7				3	16.6	−65.7
Weighted means		11.8	−55.8		12.1	−56.9		10.9	−57.5		10.3	−55.2		11.2	−57.6		10.0	−53.4		12.0	−55.1
Mean potential temperature (weighted)	344.3			347.3			328.4			324.3			331.8			324.0			345.6		

Potential temperatures, ° A	Denver, Colo.			El Paso, Tex.			Ely, Nev.			Joliet, Ill.			Lakehurst, N. J.			Medford, Oreg.			Miami, Fla.		
	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature
			°C.			°C.			°C.			°C.			°C.			°C.			°C.
290–299										2	5.2	−30.0				2	6.5	−38.5			
300–309				1	7.0	−33.0	1	8.5	−48.0	6	7.9	−39.3	1	8.0	−44.0	3	7.6	−40.7			
310–319	19	8.9	−45.2	7	7.4	−31.9	16	8.3	−39.8	19	9.3	−52.8	14	9.2	−51.0	9	8.5	−41.9			
320–329	36	10.3	−53.2	18	9.8	−45.8	31	10.3	−54.6	22	10.5	−56.0	6	10.8	−59.0	36	10.7	−56.9			
330–339	18	11.7	−60.7	23	11.6	−58.0	16	11.5	−59.1	11	11.1	−57.2	4	11.6	−60.5	15	11.8	−60.8	13	10.9	−47.4
340–349	11	12.4	−61.0	11	12.2	−58.5	7	12.5	−63.3	3	12.1	−60.0	1	11.2	−52.0	1	13.0	−66.0	17	12.5	−58.0
350–359	3	13.2	−62.7	10	13.5	−64.3	5	13.2	−63.9	2	13.4	−67.0				3	12.9	−61.3	18	13.9	−65.7
360–369	2	14.0	−63.0	11	14.5	−67.8	5	13.6	−61.6	4	13.7	−62.2				4	13.8	−63.0	13	14.9	−69.5
370–379	1	14.8	−65.0	8	15.2	−69.2	1	14.4	−61.0	3	14.0	−61.0	1	14.2	−61.0	2	14.8	−64.5	12	15.8	−73.3
380–389	3	15.4	−66.3	10	15.9	−70.3	3	15.3	−65.3	3	14.4	−60.0				2	15.0	−65.0	7	16.3	−73.0
390–399	3	15.8	−65.3	6	16.0	−67.2	5	15.6	−64.8	1	14.7	−58.0				3	16.0	−68.3	6	16.8	−73.3
400–409	3	16.2	−64.0	4	16.7	−68.2	4	16.3	−65.8	2	16.0	−64.5							5	17.5	−73.4
Weighted means		11.2	−55.6		12.6	−58.6		11.4	−55.7		10.7	−54.8		9.6	−54.3		11.1	−56.3		13.3	−64.7
Mean potential temperature (weighted)	335.1			350.9			338.5			331.6			323.6			332.8			362.0		

Potential temperatures, ° A	Minneapolis, Minn.			Nashville, Tenn.			Oakland, Calif.			Oklahoma City, Okla.			Omaha, Nebr.			Phoenix, Ariz.			St. Louis, Mo.		
	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature
			°C.			°C.			°C.			°C.			°C.			°C.			°C.
290–299	1	6.4	−39.0	2	6.4	−33.0													1	7.2	−45.0
300–309	7	7.8	−46.1	16	8.5	−42.5							7	7.8	−42.6				6	7.7	−43.5
310–319	25	9.3	−51.3	16	9.9	−49.8	11	8.3	−39.2	11	8.3	−40.5	29	9.0	−48.2	12	8.1	−37.8	17	9.1	−49.8
320–329	26	10.7	−59.3	13	11.0	−52.7	42	10.3	−53.0	28	10.2	−51.6	31	10.3	−57.8	21	10.1	−51.2	22	10.4	−55.8
330–339	8	11.7	−62.0	6	12.8	−64.3	24	11.8	−61.5	12	11.7	−59.1	11	11.6	−60.9	18	11.0	−53.8	13	11.8	−62.5
340–349	4	12.3	−63.0				9	12.8	−64.8	14	12.6	−62.4	6	12.3	−61.0	9	12.5	−61.6	2	11.6	−57.0
350–359				2	13.7	−61.0	7	13.1	−61.7	3	13.1	−63.0	2	13.4	−64.0	10	13.1	−60.3	3	12.8	−59.7
360–369				2	14.8	−65.5	3	13.8	−64.7	5	14.1	−65.2	1	13.0	−55.0	4	14.1	−63.2	5	13.4	−61.2
370–379	1	13.7	−59.0	4	15.4	−67.2	4	14.6	−64.0	8	14.7	−64.6	2	14.4	−64.5	8	14.6	−64.8	5	14.3	−62.0
380–389				1	15.2	−61.0	4	15.4	−67.8	5	15.3	−66.2				2	15.8	−70.5	1	14.8	−66.0
390–399	1	15.8	−65.0	3	16.5	−66.0	6	16.1	−68.2	2	15.4	−64.0	3	15.4	−63.7	4	16.2	−68.0	1	15.9	−65.0
400–409	1	15.4	−62.0				2	16.7	−68.0	7	16.5	−66.7	2	16.2	−62.5	8	16.6	−67.8	2	16.4	−67.5
Weighted means		10.1	−55.2		10.9	−52.2		11.7	−57.3		12.0	−57.2		10.4	−54.8		12.0	−56.1		11.0	−56.0
Mean potential temperature (weighted)	322.8			337.0			339.0			345.8			328.6			346.4			332.8		

TABLE 4.—*Mean altitudes and temperatures of significant points identifiable as tropopauses during November 1939, classified according to the potential temperatures (10-degree intervals between 290° and 409° A.) with which they are identified. (Based on radiosonde observations)*—Continued

Potential temperatures, °A.	San Antonio, Tex.			Sault Ste. Marie, Mich.			Spokane, Wash.		
	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature
			°C.			°C.			°C.
290–299	------	------	------	4	6.6	−43.8	1	6.7	−42.0
300–309	------	------	------	11	8.3	−51.2	1	7.8	−46.0
310–319	------	------	------	22	10.0	−58.9	14	9.4	−51.4
320–329	13	9.9	−46.5	16	10.9	−62.9	29	10.7	−57.6
330–339	21	11.3	−53.9	5	11.9	−64.0	13	11.7	−62.5
340–349	17	12.5	−60.1	------	------	------	5	12.5	−63.0
350–359	15	13.5	−63.7	------	------	------	3	13.2	−62.0
360–369	6	14.6	−68.2	------	------	------	2	13.8	−65.0
370–379	7	15.2	−68.3	------	------	------	2	13.6	−58.5
380–389	7	15.9	−69.4	1	13.6	−56.0	1	15.1	−63.0
390–399	5	16.5	−70.6	1	15.6	−67.0	1	15.4	−62.0
400–409	2	16.6	−66.0	------	------	------	------	------	------
Weighted Means	------	12.9	−50.9	------	10.0	−58.1	------	11.2	−57.8
Mean potential temperature (weighted)		351.8			318.1			330.7	

RIVERS AND FLOODS

[River and Flood Division, MERRILL BERNARD in charge]

By BENNETT SWENSON

Drought conditions continued during November 1939, over most of the country and record low stages for the month were established at a number of stations. No floods were reported.

WEATHER ON THE ATLANTIC AND PACIFIC OCEANS

[The Marine Division, I. R. TANNEHILL in charge]

NORTH ATLANTIC OCEAN, NOVEMBER 1939

By H. C. HUNTER

Atmospheric pressure.—Pressure averaged higher than normal over the west-central, south-central, and southeastern portions, particularly the southeastern. It was lower than normal over the extreme northwestern area. From the parallel of 40°, north latitude, southward the pressure almost everywhere averaged higher during the second half of the month than it had during the first half.

The extremes of pressure noted in available vessel reports are 1,035.6 and 965.1 millibars (30.58 and 28.50 inches). The high mark was noted on the American steamship *Narbo*, during the forenoon of the 23d, near 46° N., 32½° W. Table 1 indicates a slightly higher reading on shore at Horta, occurring on the 24th. The low mark was noted on the American steamship *Lafayette*, at 6 p. m. of the 5th, near 55° N., 10° W.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, November 1939*

Station	Average pressure	Departure	Highest	Date	Lowest	Date
	Millibars	*Millibars*	*Millibars*		*Millibars*	
Julianehaab, Greenland [1]	995.9	−5.1	1,016	14	967	4
Lisbon, Portugal [2]	1,023.8	+6.5	1,034	16, 17	1,010	4
Horta, Azores	1,023.5	+3.2	1,036	24	1,010	6
Belle Isle, Newfoundland [1]	1,007.5	−.6	1,033	22	983	7
Halifax, Nova Scotia	1,016.2	+1.9	1,032	4	999	1, 17
Nantucket	1,019.3	+1.7	1,034	4	996	1
Hatteras	1,021.7	+3.1	1,031	10	1,007	20
Turks Island	1,013.6	−2.0	1,019	16	1,006	4
Key West	1,017.6	+1.0	1,024	27	1,012	19
New Orleans	1,022.7	+3.4	1,034	27	1,012	18

[1] For 26 days.
[2] For 25 days.

NOTE.—All data based on a. m. observations only, with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Cyclones and gales.—The North Atlantic seems to have been about as stormy as in an average November, but the first half was stormier than the second half, and the final 5 days appear to have been nearly free from important storms.

Two instances of winds of hurricane force were reported, the first by the Danish steamship *Nevada*, on the 12th, near 51° N., 36° W., and the second by the American steamship *Lafayette*, on the 15th, approximately at 40° N., 38° W. Winds almost as intense, namely, of force 11, were noted by three vessels during the first week of the month, two of these being over the eastern part of the ocean, while the third was over waters to southward of Newfoundland, in connection with the disturbance of tropical origin which is mentioned elsewhere in this issue. A fourth instance of force 11 wind was noted, not quite a week before the month ended, in the vicinity of Sable Island.

Tropical disturbance.—Elsewhere in this REVIEW appears an account of the disturbance which started within the Tropics, late in October, and advanced slowly at first, crossing eastern Cuba on November 4, then moved swiftly northeastward till at last the morning of November 8, when it was central to the eastward of Labrador.

Fog.—Remarkably few reports of fog have been received. No portion of the North Atlantic is indicated to have had fog on 4 or more days, but two 5° squares are known to have had some on 3 days each. The occurrences for one of these, at the southern tip of the Grand Banks, were on widely scattered dates, but all the dates were within the period 11th to 16th in the case of the other square, which was in the northwestern Gulf of Mexico, 25° to 30° N., 90° to 95° W.

No fog whatever was reported near the coast of North America between Nova Scotia and Cape Hatteras, where there usually is a little fog during November. The region of the Grand Banks seems to have had less than half the normal amount of November fog.

OCEAN GALES AND STORMS, NOVEMBER 1939

Vessel	Voyage		Position at time of lowest barometer		Gale began November	Time of lowest barometer, November	Gale ended November	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Direction and highest force of wind	Shifts of wind near time of lowest barometer
	From—	To—	Latitude	Longitude									
NORTH ATLANTIC OCEAN			° ′	° ′				*Millibars*					
Tuscaloosa City Am. S. S.	Avonmouth	Houston	49 40 N.	25 10 W.	1	2p, 1	1	1,000.7	NW.	NW, 9	NNW.	NW, 9	
City of Alma, Am. S. S.	Glasgow	New York	50 06 N.	34 46 W.	2	4p, 2	3	991.5	W.	W, 9	NW.	W, 9	W-WNW.
Seatrain Havana, Am. S. S.	Havana	New Orleans	23 09 N.	82 21 W.	2	8p, 2	4	1,014.2	NNE.	NNE, 7	N.	NNE, 7	
Veendam, Du. S. S.	Southampton	New York	[1]49 57 N.	28 18 W.	2	Mdt, 2	3	988.9	SW.	W, 7	WNW.	WNW, 10	SSW-WNW.
Amapala, Hond. S. S.	Santiago	Kingston	18 37 N.	76 05 W.	2	8a, 3	3	997.3	E.	ESE, 10	SSW.	ESE, 10	ES-E.
Rotterdam, Du. M. S.	Baytown	Amsterdam	46 11 N.	20 30 W.	1	11a, 3	4	995.3	NW.	WNW, 7	WNW.	NW, 11	
Olancho, Am. S. S.	Barrios	Mobile	[1]18 20 N.	87 02 W.	3	4p, 3	4	1,014.2	NW.	NW, 7	N.	N, 7	NW-N.
Vermont, Am. S. S.	Jacksonville	Cristobal	[1]27 18 N.	76 04 W.	2	4a, 4	4	1,012.9	NNE.	ENE, 7	ENE.	NE, 9	
Kansan, Am. S. S.	do	do	19 18 N.	74 42 W.	4	5a, 4	4	1,005.1	SSE.	SSE, 6	SW.	S, 8	None.
City of Alma, Am. S. S.	Glasgow	New York	47 25 N.	40 21 W.	3	10a, 4	6	991.9	WSW.	NW, 8	NNW.	WNW, 10	WSW-NW.
Veendam, Du. S. S.	Southampton	do	48 42 N.	38 15 W.	4	Noon, 4	5	987.9	SW.	WNW, 8	NNW.	NW, 10	SW-NW.
Tuscaloosa City, Am. S. S.	Avonmouth	Houston	45 12 N.	37 24 W.	4	4p, 4	6	993.2	WNW.	WNW, 8	NNW.	WNW, 10	WSW-NW.
Margaret Lykes, Am. S. S.	Port au Prince	Galveston	21 00 N.	75 15 W.	4	4p, 4	6	998.6	E.	SE, 8	NNW.	NE, 8	SE-NE.
Collamer, Am. S. S.	Havre	Boston	48 55 N.	25 50 W.	4	Mdt, 4	7	977.0	WSW.	SW, 7	NNW.	N, 10	WSW-SW. WNW.
Nankai Maru, Jap. M. S.	Antwerp	New York	49 34 N.	5 30 W.	4	6a, 5	8	975.3	NW.	S, 7	WSW.	NW, 9	S-W.
Vacuum, Am. S. S.	Boston	Beaumont	37 34 N.	73 53 W.	5	Noon, 5	5	995.3	NNE.	NNW, 10	NW.	NNW, 10	NNE-NW.
Excello, Am. S. S.	Gibraltar	New York	38 54 N.	70 00 W.	5	3p, 5	5	1,004.4	E.	S, 8	S.	ESE, 10	ESE-S.
Atlantic, Am. S. S.	Cristobal	Boston	39 40 N.	69 53 W.	5	6p, 5	6	1,000.4	E.	SSE, 8	W.	S, 10	ESE-S.
Jolee, Am. S. S.	Boston	Norfolk	40 00 N.	72 30 W.	5	6p, 5	5	992.2	NW.	NW, 8	NW.	NW, 8	NE-NW.
Lafayette, Am. S. S.	Glasgow	Mobile	54 35 N.	10 10 W.	5	6p, 5	7	965.1	SSE.	SSW, 7	SE.	SE, 11	SSE-SW.
Delfina, Am. S. S.	Norfolk	San Juan	27 00 N.	71 00 W.	5	11p, 5	5	993.2	NE.	SW, 9	W.	SW, 9	NE-SW-W.
Schoharie, Am. S. S.	Glasgow	Savannah	45 13 N.	29 42 W.	4	10a, 6	7	985.4	W.	WNW, 9	NNW.	W, 10	
Veendam, Du. S. S.	Southampton	New York	[1]43 30 N.	55 06 W.	7	6a, 7	7	995.5	S.	S, 9	W.	W, 11	S-W.
Mevania, Am. S. S.	Houston	do	24 44 N.	80 33 W.	9	4p, 9	10	[2]1,020.7	NE.	NE, 7	NE.	NE, 8	None.
Lubrafol, Belg. M. S.	Gothenburg	Corpus Christi	44 17 N.	42 12 W.	10	Noon, 10	11	992.9	W.	SW, 5	NW.	WNW, 10	SW-W.
Collamer, Am. S. S.	Havre	Boston	44 11 N.	44 44 W.	9	Noon, 10	11	989.5	S.	WSW, 9	WNW.	W, 10	SSW-WNW.
Nevada, Dan. S. S.	Copenhagen	Baltimore	51 20 N.	36 10 W.	11	11p, 12	14	[3]976.3	E.	W, 11	WNW.	W, 12	
Bacchus, Du. S. S.	Trinidad	New York	19 42 N.	65 42 W.	14	7p, 13	16	1,011.2	NE.	ESE, 1	NE.	E, 8	
Lewis Luckenbach, Am. S. S.	Cristobal	do	12 18 N.	78 18 W.	14	7a, 14	16	1,011.2	ENE.	NE, 6	ENE.	ENE, 8	
Tanimbar, Du. M. S.	Capetown	Boston	38 54 N.	65 54 W.	14	Noon, 14	15	1,010.2	NW.	NW, 9	NNW.	NW, 10	
Lafayette, Am. S. S.	Glasgow	Mobile	40 10 N.	38 45 W.	14	Noon, 15	16	1,001.0	S.	SSW, 10	WSW.	S, 12	SSW-WSW.
Gateway City, Am. S. S.	Antwerp	Brunswick, Ga.	42 24 N.	33 36 W.	14	10p, 15	16	1,003.4	SSW.	SSW, 10	SSW.	SSW, 10	None.
Beemsterdijk, Du. S. S.	Rotterdam	Boston	48 34 N.	45 15 W.	18	4p, 18	19	995.8	SE.	SSW, 9	WSW.	SW, 10	SSW-WSW.
Wacosta, Am. S. S.	Antwerp	San Juan	50 20 N.	1 45 W.	18	1a, 19	19	1,007.5	SW.	SW, 8	N.	NNW, 9	SW-NW.
Beemsterdijk, Du. S. S.	Rotterdam	Boston	42 58 N.	68 32 W.	21	Noon, 22	22	1,005.8	ENE.	NE, 9	NNW.	NNE, 10	ENE-N.
Narbo, Am. S. S.	Glasgow	New Orleans	47 00 N.	30 48 W.	22	10p, 22	22	1,018.6	NNW.	NE, 9	NNE.	NNE, 9	NNW-NE-NNE.
Cayuga, U. S. C. G.	On patrol		42 24 N.	59 00 W.	24	3a, 25	26	1,016.9	NE.	NE, 10	NE.	NE, 11	None.
Nemaha, Am. S. S.	London	Baltimore	36 06 N.	62 36 W.	25	8a, 25	25	1,001.0	SW.	SW, 9	WNW.	W, 9	SW-W.
Statendam, Du. S. S.	Rotterdam	New York	48 42 N.	28 12 W.	29	10a, 30	29	996.6	SW.	WNW, 3		SW, 9	
NORTH PACIFIC OCEAN													
Atlantic City, Am. S. S.	Los Angeles	Balboa	14 54 N.	96 34 W.	[4]31	4p, 31 [4]	2	1,010.2	E.	NE, 8	NE.	ENE, 9	E-NNE-ENE
Nyhorn, Nor. M. S.	San Francisco	do	15 12 N.	96 00 W.	1	4p, 1	2	1,010.6	NE.	NE, 6	N.	NNW, 8	E-NNW.
Dakotan, Am. S. S.	Los Angeles	do	14 36 N.	93 12 W.	4	6p, 4	4	1,010.8	NNE.	NNW, 4	NNW.	N, 8	NNW-E.
City of San Francisco, Am. S. S.	do	do	15 36 N.	98 24 W.	5	6p, 4	5	1,011.9		S, 2		NNE, 9	
Koryu Maru, Jap. M. S.	Kamaisi	Everett	[1]49 51 N.	177 37 W.	7	4p, 6	4 8	983.6	SSE.	SSW, 5	WNW.	W, 11	SSW-W.
Swiftsure Bank Lightship, U. S.	On station		48 33 N.	125 00 W.	7	Mdt, 7	8	1,006.4	S.	W, 7	NW.	NW, 8	NW-W-NW.
Memphis City, Am. S. S.	Balboa	Los Angeles	13 50 N.	95 06 W.	7	4a, 8	8	1,013.2	NE.	N, 8	NNE.	N, 9	NE-N-NE.
Swiftsure Bank Lightship, U. S.	On station		48 33 N.	125 00 W.	9	4a, 10	10	1,011.2	SE.	SSE, 7	SW.	SE, 8	SE-SW.
Thor I, Nor. M. S.	Apia	Manzanillo	10 00 N.	127 10 W.	10	4a, 10	10	1,007.9	ENE.	ENE, 6	ENE.	ENE, 7	
Tai Yang, Nor. M. S.	Yokohama	Los Angeles	48 24 N.	171 00 W.	11	1p, 12	11	1,001.0		SW, 3		ESE, 8	
L. P. St. Clair, Am. S. S.	Balboa	do	15 32 N.	95 39 W.	12	4p, 12	12	1,009.0	N.	NE, 7	W.	NNE, 8	NNE-NE-W.
Huguenot, Am. S. S.	Seattle	Portland, Ore.	47 00 N.	124 42 W.	12	4p, 12	12	1,014.2		SE, 7		SE, 8	
Nordbo, Dan. M. S.	Osaka	Seattle	40 36 N.	150 42 E.	12	2p, 13	14	1,003.6	S.	W, 9	W.	W, 9	
H. D. Collier, Am. S. S.	San Francisco	Balboa	14 18 N.	95 05 W.	13	4p, 13	14	1,009.1	ENE.	N, 7	NNW.	N, 7	NE-NNW.
Texmar, Am. S. S.	Los Angeles	do	[1]15 07 N.	95 54 W.	13	3p, 13	14	1,008.8	NE.	NE, 6	N.	N, 9	NE-N.
Taketoyo Maru, Jap. S. S.	Yokohama	Los Angeles	43 30 N.	160 06 E.	15		15		W.		W.	W, 8	
Toyama Maru, Jap. S. S.	Muroran	Vancouver, B. C.	49 24 N.	172 42 W.	14	1p, 14	15	974.7	SSE.	SE, 7	NW.	WNW, 10	SE-W-WNW.
Syoyo Maru, Jap. S. S.	Tokuyama	Los Angeles	42 48 N.	171 24 W.	15	1p, 14	15	1,002.4	WNW.	WNW, 7	W.	W, 10	S-WNW.
Satartia, Am. S. S.	Nagoya	Seattle	50 00 N.	162 06 W.	14	3p, 15	16	979.0	SE.	SW, 9	NE.	WSW, 10	WSW-SE.
Iowan, Am. S. S.	Balboa	Los Angeles	13 24 N.	91 42 W.	16	6p, 15	16	1,009.8	N.	WNW, 3	WSW.	N, 7	
Nordbo, Dan. M. S.	Osaka	Seattle	42 42 N.	162 48 E.	15	1a, 16	16	995.0	S.	WNW, 6	W.	S, 10	S-WNW.
Laura Maersk, Dan. M. S.	Yokohama	Los Angeles	41 00 N.	173 00 W.	15	8a, 16	16	965.5	SE.	W, 9	NW.	SW, 10	SW-WNW.
Syoyo Maru, Jap. S. S.	Tokuyama	do	42 36 N.	155 00 W.	17	1p, 17	17	971.2	SW.	SW, 12	WSW.	SW, 12	SW-WSW.
Sanuki Maru, Jap. M. S.	Yokohama	do	40 30 N.	167 30 W.	18	1p, 18	18	972.6		N, 8		N, 8	NNE-NNW.
Satartia, Am. S. S.	Nagoya	Seattle	49 42 N.	137 12 W.	19	3p, 19	19	998.0	SE.	SSE, 9	S.	SSE, 9	SE-S.
Brajara, Nor. M. S.	Yokohama	Port San Luis	41 18 N.	159 12 W.	21	2p, 21	22	998.1	N.	NNW, 6	WNW.	NNW, 9	N-NW.
Taketoyo Maru, Jap. S. S.	do	Los Angeles	45 35 N.	145 30 W.	21	8a, 22	22	958.0	E.	NW, 7	WSW.	E, 10	NE-NW-W.
West Ira, Am. S. S.	Champerico	San Diego	15 55 N.	93 51 W.	23	3a, 23	23	1,007.5	NE.	NE, 6	NE.	NW, 8	
Columbian, Am. S. S.	Balboa	do	13 12 N.	91 00 W.	24	6p, 23	24	1,009.1	N.	ESE, 3	NE.	N, 10	NE-ESE.
San Simeon, Am. S. S.	do	do	15 00 N.	93 06 W.	25	6p, 25	26	1,009.1	NNW.	NW, 3	N.	N, 8	NW-NNW.
Bengkalis, Du. S. S.	Gingoog, P. I.	Los Angeles	36 40 N.	174 53 W.	25	Mdt, 25	26	1,014.6	NW.	NW, 9	NNW.	NW, 9	None.
Kaimoku, Am. S. S.	Balboa	do	14 18 N.	92 00 W.	28	6p, 27	28	1,010.5		WNW, 3	NNE.	NNE, 8	WNW-N.
Montanan, Am. S. S.	do	do	[1]14 46 N.	93 12 W.	29	a, 29	29	1,012.2	NNW.	WNW, 2	NE.	NNW, 7	WNW-NNW.
Bengkalis, Du. S. S.	Gingoog, P. I.	do	37 24 N.	151 18 W.	30	2a, 30	30	993.0	W.	WSW, 5	W.	WSW, 10	WSW-W.

[1] Position approximate.
[2] Barometer uncorrected.
[3] Lowest reading at regular observations; barometer probably lower between observations.
[4] October.

NORTH PACIFIC OCEAN, NOVEMBER 1939

By WILLIS E. HURD

Atmospheric pressure.—There was a marked deepening of the Aleutian LOW since the preceding October, but its average location had changed very little and it was still central in the western Gulf of Alaska. The average at Kodiak was 994.0 millibars (29.35 inches) which was 7.0 millibars (0.21 inch) below the normal of the month. Subnormal pressures continued to the eastward and southward along the Alaskan coast.

In middle latitudes, from the west coast of the United States southwestward to Midway Island, pressure was generally high—from normal to above normal. To the westward of Midway, the belt of high pressure continued to the China coast.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure at sea level, North Pacific Ocean, November 1939, at selected stations*

Stations	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Millibars	*Millibars*	*Millibars*		*Millibars*	
Point Barrow	1,013.6	−2.0	1,033	11	999	24
Dutch Harbor	1,001.6	−0.4	1,018	26	979	7
St. Paul	1,004.8	+2.8	1,027	26	985	4
Kodiak	994.0	−7.0	1,009	7	983	9
Juneau	1,003.7	−4.1	1,020	6	986	11
Tatoosh Island	1,017.6	+2.7	1,029	27	1,003	13
San Francisco	1,019.0	0.0	1,025	30	1,011	25
Mazatlan	1,012.3	+0.1	1,015	7	1,010	12-13
Honolulu	1,016.3	−0.3	1,021	20	1,011	28
Midway Island	1,021.7	+3.1	1,026	9-10, 21	1,013	30
Guam	1,009.7	−1.5	1,012	15, 17	1,006	1, 20
Manila	1,010.0	−0.2	1,014	15, 26	1,005	7-9
Hong Kong	1,015.9	−1.4	1,024	29, 30	1,006	23
Naha	1,017.6	+2.4	1,025	29, 30	1,010	9
Titijima	1,016.2	+1.0	1,023	2, 27	1,000	19
Petropavlovsk	1,004.0	−1.1	1,028	20	976	26

NOTE.—Data based on 1 daily observation only, except those for Juneau, Tatoosh Island, San Francisco, and Honolulu, which are based on 2 observations. Departures are computed from best available normals related to time of observation.

Extratropical cyclones and gales.—So far as reports indicate, November was stormier than October only in eastern waters of the North Pacific. Between about longitudes 130° and 155° W., no winds of force as high as 8 were reported in October but several of higher force than 8 occurred in November. The stormiest part of the ocean was that lying between about 150° W. and the 180th meridian. No gales of consequence, however, were reported from extratropical waters during the first few days of the month.

On November 6 a rather deep cyclone lay over the western Aleutians. At 4 p. m. the Japanese motorship *Koryu Maru*, near 50° N., 178° W., had a barometer of 983.6 millibars (29.05 inches), with a strong southwesterly wind. During most of the afternoon of the 7th, near 50° N., 172° W. the ship was in a westerly gale of force 11, decreasing to force 9 late at night, and continuing of about the same force until late in the afternoon of the 8th, at which time the ship had advanced to about 165° W. During the 7th and 8th rough weather covered a large extent of ocean south of the Aleutians. On the 9th the storm moved into the Gulf of Alaska (barometer at Kodiak, 983 millibars—29.03 inches) and along its eastern extremity at times during the 10th to 14th, fresh gales occurred in Washington and Oregon coastal regions.

The middle days of November were in general the stormiest of the month, with three cyclones in progress. Gale areas were of wide extent, particularly on the 15th and 16th, accompanied by low barometer readings in higher middle longitudes, which continued until the 18th.

The earliest of the three cyclones was centered near the Kuril Islands on the 13th, and a little to the eastward on the 15th, after which it disappeared from observation. On the 13th the Norwegian motorship *Nordbo* had a west gale of force 9, with moderately depressed barometer, near 41° N., 151° E. On the 15th two ships reported gales within the region 42° to 44° N., 160° to 163° E. The stronger, of force 10 from the south, was experienced by the motorship *Nordbo*.

The other two storms were first observed as of considerable energy in middle longitudes on the 15th, one over the central Aleutians, and the other to the southward on ths middle steamer route. The paths of these disturbancee converged as they went eastward, and apparently merged on the 17th about midway between the Hawaiian Islands and the Gulf of Alaska. During the 15th and 16th several ships encountered fresh to whole gales between 35° N. and the Aleutians, longitudes 160° and 175° W. Among them the Danish motorship *Laura Maersk*, near 41° N., 173° W., on the 16th, had a low barometer reading of 965.5 millibars (28.51 inches), with a west gale of force 9 changing to a gale of force 10 from the southwest.

On the 17th the principal gale region of the storm lay between 35° and 45° N., 150° and 160° W., and within this region that day the heaviest reported wind of the month occurred. The Japanese steamer *Syoyo Maru* had full storm to hurricane gales from about 10 a. m. to 6 p. m., with lowest barometer 971.2 millibars (29.68 inches) in 42°36′ N., 155°00′ W.

From the 19th to 22d scattered gales of force 9–10 were encountered along the northern and middle routes between 135° and 160° W. The lowest barometer reading of the month, 958.0 millibars (28.29 inches) was read on board the Japanese steamer *Taketoyo Maru* on the 22d, in 45°35′ N., 145°30′ W., accompanied by a northwest wind of force 7, but preceded by an east gale of force 10.

Thereafter the most important of the few scattered gales reported in west longitudes was from the west-southwest, force 10, experienced by the Dutch steamer *Bengkalis* near 37° N., 151° W., on the 30th. The ship's lowest barometer was 993 millibars (29.32 inches).

In east longitudes, during the last decade of November, local gales of force 8 were met on the 22d and 23d in about 30° N., 157° to 165° E. From the 25th to 27th heavy storm conditions affected northern Japanese waters, the Sea of Okhotsk, and the extreme western part of the Bering Sea. Gales of force 8 to 9 were reported by several stations along the coasts.

Tropical cyclones.—Elsewhere in this issue of the REVIEW is an account of several depressions and one typhoon that occurred in the Far East during the month. The account was prepared by the Reverend Bernard F. Doucette, S. J., of the Weather Bureau at Manila, P. I.

Tehuantepecers.—Pronounced Tehuantepecer weather was unusually frequent in the Gulf of Tehuantepec during November 1939. The month had 13 days with northerly winds of force 7 to 10, which much exceeds the record of previous November occurrences of the past 16 years. Gales of force 7 occurred on the 13th, 16th, and 29th; of force 8 on the 1st, 2d, 4th, 23d, 26th, and 28th; of force 9 on the 5th, 8th, and 14th; and of force 10 on the 24th. A special account of the Tehuantepecer of the 24th appears elsewhere in this issue of the REVIEW.

Fog.—There were only a few scattered occurrences of fog on all the ocean west of longitude 135° W. With approach to the California coast, fog became more frequent, and in coastal waters was reported by ships on 14 days. Ships

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along the Washington and Oregon coasts reported it on 9 days.

TEHUANTEPECER OF NOVEMBER 24, 1939

By WILLIS E. HURD

During the afternoon of November 24, 1939, an anticyclone of considerable magnitude lay central over the southern part of the United States, with a southward extension over the Gulf of Mexico, a pressure condition especially favorable for the production of the overflow type of norther in the Gulf of Tehuantepec known as the "Tehuantepecer."

The American steamer *Columbian* was passing near the shore from east to west across the Gulf of Tehuantepec and caught the strong force of the blow. In a special report of the gale made for the Weather Bureau by the vessel's observer, Second Officer William E. Brown, several interesting meteorological points mentioned are worthy of presentation.

At local noon the ship was in latitude 15°50′ N., longitude 93°45′ W., with a wind from the northeast, force 2, barometer 29.90. The sea was smooth, with a moderate northwest swell. At 12:20 p. m., there was a slight shift of the wind to north, force 6, then a decline an hour and a half later to force 3 from the same direction. At 3:30 p. m., in 16°07′ N., 94°32′ W., the wind changed to northwest, increasing, and rising to force 10 at 4:15 p. m., later gradually hauling into north. At 10 p. m., in 15°44′ N., 95°44′ W., the wind was northeast, force 4, diminishing.

The following paragraphs are excerpts from Officer Brown's report:

> The sky was nearly overcast at noon, with cirrus and altocumulus, which moved from the north slowly. As the vessel approached the head of the Gulf, the clouds disappeared directly overhead, leaving a clear sky in the wake of the wind, but with the same type of clouds perceptible on either side of the Gulf. At all times there were heavy cumulus clouds lying in the pass of the mountains from where the wind issued.
>
> The first wind encountered shortly after noon apparently was a side blow, diverted in the mountains and passing to the east of the Chimalapa Region, while the full force of the norther was not encountered until farther west, when it descended from the westward of the Chimalapa Region.
>
> The sea increased with the wind, the waves reaching a height of about 10 feet. With the increase in the sea, the swell disappeared shortly after noon. The seas being very short, the vessel shipped no water.
>
> From 5:30 p. m., in latitude 16°08′ N., longitude 94°53′ W., the air temperature dropped from 82° to 74°, and the sea temperature, from 84° to 68°, remaining so until 6:30 p. m., in 16°05′ N., 95°02′ W., when sea rose again to 82° and air began to rise.
>
> The barometer was entirely normal during the period and showed only the usual 4 p. m. low.

In connection with the severe Tehuantepecer weather described in the foregoing, it may be added that, according to Weather Bureau records for the 15-year period 1924–1938, November (closely followed by January) is the month of most frequent norther gales (force 8 to 12) that occur in the Gulf of Tehuantepec during the season October to April. Practically one-fourth of the entire number reported by ships during the period have been experienced in November.

TYPHOONS AND DEPRESSIONS OVER THE FAR EAST, NOVEMBER 1939

By BERNARD F. DOUCETTE, S. J.

[Weather Bureau, Manila, P. I.]

Depression, November 4–9, 1939.—This disturbance first appeared about 300 miles east of northern Mindanao, from which location it moved rapidly in a west-northwesterly direction toward Samar. A slight inclination to the west during the early morning hours of November 5 brought the center to a position about 30 miles south-southeast of Marinduque. Then, during the day, there was a change to the northwest for about 60 miles and finally, during the evening hours, a shift to the west-northwest as the center pased over Batangas Province. It entered the China Sea during the night of November 5–6. The four days, November 6 to 9, saw the depression incline to the north and northeast and finally disappear over the regions southwest of Formosa.

On November 5, when the depression center was about 50 or 60 miles southeast of Manila, and changing its course toward Batangas Province and the China Sea, a typhoon situation developed over central and southern Luzon. Late in the forenoon the low clouds began to move very fast from northwesterly and northerly directions; the wind became gusty up to 48 k. p. h. at the Observatory; and the sky had all the appearances indicating the existence of a typhoon close at hand. Yet the pressure at the Observatory was not low and did not give many indications that it would fall. In the writer's opinion, it was merely a minor surge of air from the north intensified by the circulation of the depression and the proximity of the mountains (Mount Banahao and Mount Maquiling). There was very little activity south and southwest of the depression center, a factor which made it doubtful whether or not a real typhoon was present. However, there were a few stations that reported minimum values rather low, which were caused by local effects due to the proximity of the mountains mentioned above, in the opinion of the writer. For example, Santa Cruz, Laguna Province, had a minimum pressure value of 747.70 mm. (996.8 mb.) at 4 p. m. Lucena, Tayabas Province, reported 748.7 mm. (998.2 mb.) at 2 p. m., November 5. Ambulong, Batangas Province, had a value of 749.87 mm. (999.7 mb.) at 4 p. m. of that day. Winds were from the northwest and north quadrants at Santa Cruz, but from the southwest and west-southwest at the other stations, force 5 to 8. Canlubang, Laguna Province, had westerly winds, force 5, but the pressure did not become lower than 750.77 mm. (1,000.9 mb.).

The only aspect of the upper winds to mention is the advance of a weak southwesterly current from Medan, Sumatra Island, to Zamboanga, P. I., from November 1 to 4. Then, when the depression center formed (November 4, morning map) and moved toward the archipelago, there was an extensive sector of air flowing from the southwest. The velocities, however, were weak, and no intensification resulted, except for the pressures and winds mentioned above. In the China Sea, the disturbance was of minor importance as far as available information shows.

Depression, November 6–13, 1939.—Forming about 500 miles east of Mindanao, a depression moved west-northwest, then north, inclining slightly to the north-northwest as it moved to higher latitudes. It recurved to the northeast November 10 when about 250 miles east of Isabela Province and gradually inclined to the east-northeast during the next 3 days. November 13, it passed about 200 miles south of the Bonins, apparently weakening, and the next day its center, only a low pressure area according to available data, was east of the 150th meridian.

Typhoon, November 18–26, 1939.—The morning and afternoon situation east of Mindanao, November 18, showed the presence of a depression which either formed rapidly over these regions or had developed near or over the Western Caroline Islands previously. It moved northwest about 250 miles and then inclined to the west-northwest or west-by-north, increasing all the time to

typhoon intensity. It crossed southern Samar and northern Leyte during the afternoon and evening hours of November 19, moving in a west-northwesterly direction. It was located close to and northwest of the Island of Panay on the morning of November 20, proceeding west-northwest and passing south of Mindoro Island and a short distance north of Culion. November 21 and 22 saw the storm move toward Hainan Island, but it recurved to the north and northeast after passing about 120 miles north-northeast of the Paracels. This recurvature began during the evening hours of November 22, and the morning of the 23d found the storm moving toward the locality of Hong Kong. It passed over the Colony at 4 p. m., moving east-northeast and continued during the night to move toward the Formosa Channel. November 24 and 25 saw the storm pass over the southern part of the Formosa Channel, and most likely over southern Formosa on its way to the Pacific Ocean. It gradually weakened and no trace of it could be found on the afternoon maps of November 26.

This typhoon was violent over a small area and moved rapidly. The center passed over Guiuan, Samar Pr., where the minimum pressure was 738.74 mm. (984.9 mb.) at 3:00 p. m. (November 19). Tacloban, Leyte, recorded its minimum at 5:47 p. m., the value being 739.84 mm. (986.4 mb.) with east winds, force 7. Capiz, on the northern shore of Panay Island, had 736.07 mm. (981.4 mb.) as its lowest pressure, occurring at 2:15 a. m., November 20, with north-northeast winds, force 4. It must be noted that at 2 a. m. the station had its strongest winds during the passage of the storm, namely, force 10, from the northeast. Culion, Palawan Pr., had a minimum value of 749.04 mm. (998.7 mb.) about noon of the same day as the storm passed about 50 or 60 miles north of the station. Over the China Sea, there were no ships near the center. The S. S. *Ruys* and the S. S. *Tjibesar* were south of the course of the typhoon as it entered the China Sea, and their observations coincided with the data obtained from the Philippine stations and also showed definitely that the storm was not recurving to the northeast near the archipelago. Over Hong Kong, the pressure at 0800 G. M. T. was 29.22 in. (989.5 mb.) with southeast winds of 50 knots velocity.

The greatest loss of life during the passage of the typhoon over the Philippines was due to the sinking of the motor boat *Rosario*, near Carnada Island, Masbate, with 48 persons perishing. Two persons survived to report the fate of the boat. One man was reported missing at Balangiga, Samar, and it is supposed that he was drowned. Property loss was great in Samar, Leyte, and Capiz provinces.

Preceding the appearance of the depression center on November 18, there was a steady advance of the southwest current, first at Medan on November 15 when the upper winds changed to the southwest quadrant, and then at stations of the Straits Settlements and finally at Zamboanga and Tarakan, the morning of November 18. Menado pilots were not received regularly but it seems that the upper winds over this station did not change to the southwest and west quadrants until the afternoon of November 17. Then, as the depression formed and intensified, November 18 and 19, a complete sector with southwest quadrant winds formed covering Mindanao and the southern Visayan Islands and extending to Medan and very likely to southern Borneo. This occurred as the typhoon moved toward Samar. The sequence of pilot balloon ascension reports clearly shows the merging of the advancing current of air from the southwest with the winds circulating around the storm center east of Mindanao. Over Manila, the upper winds backed from the east to the northeast as the depression intensified and moved toward Samar. In this case, the pilots showed that there must be activity in the storm center at a time when pressure values and surface wind forces were unable to indicate such development. Then, when the storm was in the China Sea and moving along a west-northwesterly course toward Hainan Island, the pilots over northern Indochina stations were excellent in showing that those stations were in no danger. For there was always flowing a west quadrant current aloft, due to the HIGH over China, which seems to have prevented the approach of a typhoon. The pilots reported from Hong Kong during these days, when the typhoon was in the China Sea, were short ascents and not regular, so that at the present writing, it is impossible to discuss the effect of the air currents over that station upon the course of the typhoon.

Depression, November 22–27, 1939.—This depression formed east of Mindanao and moved a short distance toward the northwest reaching the ocean regions about 250 miles east of southern Samar, where the center remained stationary until it filled up, November 27. During these days it was apparently of minor importance, yet it was a threat to the archipelago, because of possible intensification.

The upper winds during these days showed activity from the southwest, but the easterly current, as indicated by Guam pilots, was weak. Over the regions southwest of the depression center, Menado had southwest and west quadrant winds, likewise Balikpapan and Bandjermasin (when they reported), but Medan and the Straits Settlements showed that the current was steady and rather strong. This southwesterly current was checked and then overcome by a strong outbreak of cold air from northern China starting November 25 and covering the whole of the Philippine archipelago by the morning of November 27, when the depression was reported as filled up or moving northeast away from the Philippines.

CLIMATOLOGICAL TABLES

CONDENSED CLIMATOLOGICAL SUMMARY

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

TABLE I.—*Condensed climatological summary of temperature and precipitation by sections, November 1939*

[For description of tables and charts, see REVIEW, January, p. 29]

Section	Temperature								Precipitation					
	Section average	Departure from the normal	Monthly extremes						Section average	Departure from the normal	Greatest monthly		Least monthly	
			Station	Highest	Date	Station	Lowest	Date			Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	52.4	−2.0	Robertsdale	85	11	5 stations	22	1 2	0.85	−2.56	Falkville	2.65	Wadley	0.00
Arizona	53.2	+2.5	2 stations	93	1	Snowflake	9	23	1.20	+.21	Crown King	3.45	Yuma	.19
Arkansas	48.8	−2.5	do	87	1 8	2 stations	14	1 5	3.36	−.38	Texarkana	6.81	Blytheville	.98
California	53.5	+1.2	El Centro	95	1	Tamarack	2	29	.43	−1.93	Mill Creek No. 2	2.39	9 stations	.00
Colorado	37.7	+2.5	Palisade	79	3	Dillon	−7	19	.26	−.52	Westcliffe	1.12	12 stations	.00
Florida	62.9	−2.1	Eustis	90	12	2 stations	24	1 28	1.35	−.84	Chapman Field Garden.	3.68	2 stations	T
Georgia	52.6	−1.9	Moultrie	86	11	Blairsville	18	27	.82	−1.79	Fargo	2.76	Taylorsville	.10
Idaho	38.3	+2.8	Oakley	73	24	2 stations	3	17	.33	−1.70	Prichard	2.30	13 stations	.00
Illinois	41.9	−.2	5 stations	73	1 9	Mt. Carroll	15	28	1.32	−1.26	Waterloo	2.82	Morrison	.14
Indiana	41.0	−1.3	2 stations	75	1 15	Farmland	13	5	1.45	−1.58	Hobart	2.36	Veedersburg	.70
Iowa	39.9	+3.6	4 stations	74	1 9	Sibley	9	27	.51	−1.09	Keokuk	1.70	12 stations	T
Kansas	44.3	+1.1	Sedan	80	7	2 stations	4	3	.83	−.44	Pittsburg	2.87	4 stations	.00
Kentucky	43.6	−2.8	Quicksand	79	10	Annville	14	27	1.16	−2.23	Lovelaceville	2.75	Louisa	.26
Louisiana	56.6	−2.2	Elizabeth	85	10	do	20	5	3.41	−.41	Houma	11.83	Bogalusa	.61
Maryland-Delaware	43.5	−1.6	Great Falls, Md	75	18	Sines, Md	12	29	1.30	−1.16	Cumberland, Md	2.63	Aberdeen, Md	.33
Michigan	36.2	+.1	2 stations	68	1 16	Vanderbilt (near)	5	26	.82	−1.09	Mancelona	3.72	Channing	.14
Minnesota	35.4	+5.8	Marshall	75	16	2 stations	0	10	.06	−1.08	Park Rapids	.60	3 stations	.00
Mississippi	52.2	−2.9	Columbia	84	10	do	17	1 5	1.50	−2.08	Cleveland	3.97	Waynesboro	.19
Missouri	43.5	−.9	Jefferson City	78	9	3 stations	12	1 4	2.58	−.09	Warrenton	4.87	Tarkio	.85
Montana	37.9	+5.7	Melstone	74	3	2 stations	−2	1 17	.23	−.78	Belton	1.57	16 stations	.00
Nebraska	40.7	+3.4	Albion	79	13	Nenzel (near)	0	2	.04	−.71	Falls City	1.31	70 stations	.00
Nevada	43.0	+3.1	Beatty	85	2	Wells	1	18	.30	−.33	Charleston Ranger Station.	1.73	4 stations	.00
New England	34.9	−3.1	Norwalk, Conn	66	18	Bangor, Maine	−1	26	1.06	−2.36	Falmouth, Mass	2.94	Durham, N. H	.15
New Jersey	41.5	−2.1	Bridgeton	78	16	Layton	12	26	1.86	−1.32	Moorestown	3.63	Phillipsburg	.84
New Mexico	41.9	−.5	Birmingham Ranch.	89	24	Eagle Nest	−4	20	.62	−.02	Frijoles Canyon	1.79	2 stations	.00
New York	35.0	−3.0	2 stations	72	10	McKeever	−5	14	1.59	−1.39	Gabriels	3.16	do	.46
North Carolina	46.9	−3.0	Beaufort	82	12	Mt. Mitchell	13	6	1.90	−.75	Hatteras	5.76	Hot Springs	.65
North Dakota	34.9	+8.2	Wahpeton	74	13	Parshall	−4	10	.03	−.56	2 stations	.14	18 stations	.00
Ohio	40.3	−1.1	2 stations	75	10	McArthur	15	1 27	.97	−1.72	London (near)	1.95	McConnelsville	.23
Oklahoma	48.4	−1.3	Sulphur	86	8	4 stations	10	1 3	1.46	−.54	Idabel	4.66	Goodwell	T
Oregon	41.2	+.8	Elkton	79	1	Seneca	−3	27	.52	−3.13	McNamurs	5.90	6 stations	.00
Pennsylvania	39.7	−1.6	3 stations	76	10	3 stations	11	1 4	.97	−1.87	Stroudsburg	3.20	Bloserville	.23
South Carolina	50.4	−3.4	Conway	84	11	Longcreek (near)	20	6	1.07	−1.25	McColl	2.04	Calhoun Falls	.16
South Dakota	39.0	+5.8	Wagner	78	14	Ottumwa	2	2	.01	−.61	Hardy Ranger Station.	.15	40 stations	.00
Tennessee	45.8	−2.7	Halls	80	10	3 stations	15	1 5	1.58	−1.96	Union City	1.86	Celina	.42
Texas	54.1	−3.0	2 stations	90	10	Muleshoe	11	26	2.01	−.17	Marshall	7.03	3 stations	T
Utah	40.7	+3.2	do	82	3	Woodruff	−4	18	.14	−.79	Orderville	.94	8 stations	.00
Virginia	44.1	−2.4	Diamond Springs	77	1 17	Burkes Garden	13	29	2.19	−.23	Big Meadows	5.57	Mendota	.51
Washington	42.2	+2.9	2 stations	73	1 21	Benton City	12	1 28	2.60	−2.42	Clearwater	19.36	3 stations	.00
West Virginia	40.8	−2.4	do	80	1 10	2 stations	10	1 27	.96	−1.77	Knobly Mountain	3.18	Brownsville	.38
Wisconsin	35.7	+2.3	Sheboygan	70	17	Willow Reservoir	6	28	.36	−1.46	Lancaster	1.50	3 stations	T
Wyoming	35.0	+3.4	Yoder	82	11	Big Piney	−8	26	.01	−.69	Dome Lake	.19	64 stations	.00
Alaska (October)	27.4	−2.8	Latouche	66	3	2 stations	−11	1 16	4.65	+1.10	Little Port Walter	38.08	Barrow	.23
Hawaii	71.0	−.7	Mana (Kauai)	90	22	Kanalohuluhulu	43	18	8.48	+.41	Kakai	50.00	Lahaina	.17
Puerto Rico	77.0	+.6	Dos Bocas	96	13	Garzas	58	15	8.05	+.92	La Mina (El Yanque)	27.24	Central San Francisco	1.45

[1] Other dates also.

TABLE 2.—*Climatological data for Weather Bureau stations, November 1939*

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°*F.*	°*F.*	°*F.*		°*F.*	°*F.*		°*F.*	°*F.*	°*F.*	°*F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
New England							**38.0**	**−1.5**										**69**	**1.13**	**−2.1**										**4.6**		
Eastport	75	67	85	29.96	30.04	+0.03	35.1	−1.6	56	1	41	19	14	29	25	32	28	77	2.53	−0.8	5	12.5	w.	38	s.	1	12	4	14	5.3	1.8	0.2
Greenville, Maine	1,069	4	41																												
Portland, Maine	103	82	117	29.98	30.11	+.10	37.0	−1.0	57	8	44	21	14	30	23	31	23	60	.56	−2.9	3	8.4	n.	35	ne.	5	22	5	3	2.6	.5	.0
Concord	288	54	72	29.81	30.13	+.07	36.4	−1.3	57	30	46	15	26	27	36				.50	−2.6	4	6.8	nw.	21	nw.	9	14	11	5	3.8	1.0	.0
Burlington	403	11	48	29.70	30.16	+.11	32.1	−4.2	51	10	39	11	26	25	31	28	23	73	.92	−1.7	5	8.0	nw.	32	s.	10	5	8	17	6.7	1.4	.0
Northfield	876	12	60	29.18	30.16	+.11	30.5	−2.3	54	11	41	5	26	20	38	24	20	74	.83	−2.1	7	7.1	n.	30	sw.	8	7	13	10	5.8	2.9	.0
Boston [1]	29	33	62	30.08	30.11	+.06	40.8	−1.2	61	16	48	21	14	33	26	33	25	58	1.14	−2.2	2	12.8	w.	56	ne.	5	13	9	8	4.8	1.0	.0
Nantucket	12	14	90	30.08	30.10	+.05	42.9	−1.5	59	8	48	25	14	38	21	39	35	75	1.19	−2.0	3	17.7	w.	45	sw.	5	11	12	7	5.2	T	.0
Block Island	26	11	46	30.08	30.11	+.05	42.3	−2.3	57	8	48	24	14	37	22	38	32	68	.92	−2.7	2	20.1	nw.	56	w.	5	18	5	7	3.6	T	.0
Providence	159	215	251	30.06	30.14	+.07	40.2	−.2	61	16	48	21	14	32	27	33	27	67	.76	−2.3	2	12.6	nw.	40	nw.	5	17	6	7	3.9	T	.0
Hartford	159	66	100	30.02	30.14	+.06	39.8	+.3	63	18	48	21	14	32	33	31	26	71	1.43	−2.1	1	10.2	n.	31	nw.	9	15	8	7	4.7	T	.0
New Haven	106	74	153	30.14	30.16	+.09	40.8	−1.2	64	18	49	22	14	33	32	33	26	65	1.70	−1.6	2	10.1	n.	40	n.	5	18	7	5	4.1	T	.0
Middle Atlantic States							**43.8**	**−1.1**										**65**	**1.45**	**−1.1**										**4.8**		
Albany [1]	292	26	40	29.84	30.16	+.08	35.2	−4.1	59	16	44	14	15	27	37	29	24	70	1.69	−1.0	4	10.0	nw.	33	nw.	13	11	8	11	5.3	1.0	.0
Binghamton	871	57	79	29.25	30.21	+.12	36.4	−2.3	66	10	45	18	26	28	39	31	26	71	.46	−1.9	7	6.4	nw.	25	nw.	9	4	14	12	6.4	.9	.0
New York	314	415	454	29.81	30.16	+.07	43.2	−1.0	65	18	50	28	14	36	27	36	26	53	1.47	−1.5	2	15.7	nw.	53	nw.	9	13	9	8	4.6	T	.0
Harrisburg [1]	351	30	49	29.53	30.22	+.11	42.8	.0	69	18	52	25	24	34	42	36	29	63	.53	−1.7	6	8.1	w.	28	sw.	10	13	9	8	4.4	T	.0
Philadelphia	114	174	367	30.06	30.19	+.09	44.9	−.8	70	18	52	33	20	38	31	37	29	59	1.26	−1.4	3	13.7	nw.	35	ne.	5	13	10	7	4.5	.4	.0
Reading	323	283	306	29.84	30.21	.....	43.8	+1.3	68	18	52	28	26	36	32	35	25	51	.59	−2.1	1	11.5	nw.	38	nw.	6	15	9	6	4.1	T	.0
Scranton	805	72	104	29.31	30.20	+.11	38.4	−2.1	62	16	46	22	24	31	34	33	27	68	.46	−2.3	3	6.8	nw.	30	nw.	9	12	11	7	4.9	.6	.0
Atlantic City	52	37	172	30.12	30.18	+.08	45.5	−.1	68	18	53	30	15	38	25	39	34	68	2.17	−.6	3	17.4	w.	45	ne.	20	13	8	9	4.9	T	.0
Sandy Hook	22	10	57	30.14	30.16	.....	43.2	−2.6	62	18	49	30	14	38	24	37	31	65	1.33	−1.9	2	17.0	w.	47	ne.	5	13	8	9	4.6	T	.0
Trenton	190	89	107	29.97	30.18	.....	42.4	−2.0	68	18	50	29	4	35	32	36	28	61	1.59	−1.1	3	9.3	nw.	27	ne.	5	9	13	8	5.0	T	.0
Baltimore [3]	123	100	215	30.20	30.21	+.10	47.4	+1.1	72	18	55	33	4	40	32	37	32	69	.76	−1.8	4	10.4	n.	34	sw.	8	14	9	7	4.1	T	.0
Washington	112	62	85	30.09	30.22	+.10	46.0	+.8	72	16	55	30	26	37	39	38	31	63	1.40	−1.0	6	7.1	nw.	22	nw.	11	14	7	9	4.6	.4	.0
Cape Henry	18	8	54	30.16	30.18	.....	49.4	−2.7	72	16	56	35	9	43	30	44	39	72	2.81	+.4	7	15.1	n.	38	ne.	20	16	2	12	4.6	.0	.0
Lynchburg	686	144	184	29.49	30.25	+.12	47.2	.0	74	18	57	29	26	37	41	38	30	60	1.89	−.4	6	7.3	nw.	22	ne.	20	13	7	10	4.5	1.2	.0
Norfolk	91	80	125	30.10	30.20	+.09	50.0	−1.4	73	17	57	35	27	43	29	43	37	69	3.14	+1.0	7	10.4	n.	32	ne.	20	14	5	11	4.9	.0	.0
Richmond [2]	144	11	52	30.04	30.22	+.10	46.6	−1.7	74	16	57	29	27	36	35	37	33	76	2.41	+.2	6	8.0	ne.	23	n.	5	15	4	11	4.4	T	.0
Wytheville	2,304	49	55	27.80	30.26	+.13	41.6	−1.4	66	10	51	23	29	32	38	34	28	68	.71	−1.4	7	6.2	w.	20	w.	11	11	5	14	5.6	2.2	.0
South Atlantic States							**52.3**	**−1.8**										**74**	**1.51**	**−0.9**										**4.7**		
Asheville	2,253	89	104	27.87	30.29	+.15	44.6	−.5	69	17	56	26	27	34	40	37	31	70	.77	−1.5	7	6.9	nw.	22	s.	10	10	7	13	5.6	.3	.0
Charlotte [2]	779	63	86	29.40	30.24	+.11	49.4	−1.2	75	17	60	31	27	39	33	40	34	70	1.09	−1.5	8	6.4	ne.	18	n.	5	15	3	12	5.0	.0	.0
Greensboro [1]	886	6	56	29.28	30.25	.....	45.1	.....	73	17	57	22	27	33	45	37	33	75	1.64	.....	7	7.5	ne.	20	nw.	5	14	6	10	4.6	T	.0
Hatteras	11	5	50	30.16	30.17	+.06	53.3	−3.0	68	18	59	40	27	48	23	49	46	81	5.76	+2.3	7	14.7	n.	34	nw.	25	16	4	10	4.3	.0	.0
Raleigh [2]	376	103	146	29.83	30.22	+.09	49.6	−1.4	74	17	58	30	26	41	30	40	34	70	1.75	−.5	7	9.2	n.	27	nw.	5	12	9	9	4.3	.0	.0
Wilmington	72	73	107	30.13	30.21	+.09	52.0	−4.0	75	11	62	29	27	42	29	45	40	74	.79	−1.2	3	7.8	n.	22	nw.	5	17	4	9	4.1	.0	.0
Charleston	48	11	92	30.16	30.21	+.09	55.0	−3.1	77	11	63	34	27	47	23	43	41	84	1.91	−.2	2	9.3	n.	26	nw.	5	13	7	10	4.7	.0	.0
Columbia, S. C.	347	70	91	29.99	30.24	+.12	51.8	−2.2	76	16	63	28	27	41	36	42	36	72	.90	−1.1	6	6.8	ne.	18	sw.	8	14	4	12	4.6	T	.0
Greenville, S. C.	1,040	70	78	29.12	30.24	.....	49.9	+.3	74	11	60	33	6	40	32	42	35	64	.42	−2.8	7	5.6	ne.	25	w.	8	14	3	13	5.0	.0	.0
Augusta [3]	182	62	77	29.76	30.22	+.09	52.4	−2.1	78	11	64	30	27	40	38	43	36	65	.46	−1.9	6	4.5	nw.	13	nw.	5	14	5	11	4.8	.0	.0
Savannah [2]	65	73	152	30.15	30.21	+.09	57.3	−1.2	82	11	68	35	27	47	30	46	44	86	.67	−1.4	3	8.8	ne.	18	n.	5	13	8	9	4.7	.0	.0
Jacksonville	43	86	110	30.13	30.17	+.07	60.3	−1.9	80	12	70	37	28	51	33	53	50	81	2.05	+.1	4	7.5	ne.	21	ne.	3	12	7	11	5.1	.0	.0
Florida Peninsula							**69.4**	**−1.6**										**77**	**1.36**	**−0.9**										**4.9**		
Key West [2]	21	10	64	30.04	30.05	+.03	72.4	−1.9	84	19	77	53	25	68	19	66	64	79	.13	−2.1	4	12.3	ne.	25	n.	23	14	5	11	4.6	.0	.0
Miami	25	124	168	30.04	30.07	+.01	70.8	−1.0	82	19	77	50	28	65	23	64	61	75	3.62	+.7	10	12.8	ne.	33	ne.	14	6	13	11	6.1	.0	.0
Tampa [2]	35	88	197	30.11	30.12	+.04	64.9	−2.0	84	12	74	43	28	56	26	57	54	76	.33	−1.4	2	13.1	n.	30	n.	23	14	9	7	4.1	.0	.0
East Gulf States							**54.9**	**−1.6**										**74**	**1.38**	**−1.9**										**4.5**		
Atlanta [1]	976	5	72	29.18	30.23	+.10	50.2	−1.9	74	8	61	30	24	39	34	42	37	72	.41	.....	7	7.3	nw.	21	nw.	8	13	5	12	4.7	.0	.0
Macon [2]	370	79	87	29.70	30.21	+.08	52.5	−1.7	77	8	65	32	27	40	38	44	39	72	.78	−1.7	3	5.8	n.	15	n.	5	11	9	10	5.0	.0	.0
Thomasville	273	49	58	29.91	30.21	+.09	57.7	−.8	82	11	70	34	27	46	34	49	45	.....	1.03	−1.6	3	.....	e.	.....	.....	.....	.....	15	8	7	4.0	.0	.0
Apalachicola	35	11	51	30.14	30.17	.....	59.0	−2.3	75	19	68	37	28	50	27	52	48	76	3.16	+.1	2	9.1	n.	32	e.	13	15	5	10	4.3	.0	.0
Pensacola	56	149	185	30.14	30.20	+.09	57.8	−2.4	74	11	66	36	28	50	27	51	45	69	2.34	−1.4	4	11.8	n.	40	e.	18	17	7	6	3.6	.0	.0
Anniston	741	9	.....	.....	.....	.....	50.4	−1.5	75	10	62	26	6	38	38	.....	.....	.....	.48	−2.9	5	.....	nw.	.....	.....	.....	14	7	9	.....	.0	.0
Birmingham [2]	630	5	55	29.57	30.26	+.14	52.2	−1.7	77	9	62	30	5	42	33	41	37	79	.75	−2.6	7	5.9	n.	18	s.	10	13	5	12	4.9	.0	.0
Mobile	57	86	161	30.18	30.22	+.11	57.0	−1.6	81	11	67	34	28	47	32	48	45	81	.69	−3.0	3	10.0	n.	47	e.	18	12	9	9	4.7	.0	.0
Montgomery [2]	218	92	105	29.97	30.23	+.11	55.1	−.7	77	10	66	34	28	45	32	44	40	75	.62	−2.6	3	6.2	n.	16	n.	3	16	3	11	4.2	.0	.0
Meridian [2]	375	67	92	29.90	30.24	+.12	52.6	−1.6	78	8	65	26	29	41	41	43	39	80	.74	−2.6	5	5.1	n.	17	sw.	10	15	3	12	4.8	.0	.0
Vicksburg [2]	247	82	102	29.97	30.24	+.12	54.4	−2.2	79	10	64	30	4	45	30	46	40	65	1.18	−2.5	5	8.4	n.	19	n.	12	10	7	13	5.7	.0	.0
New Orleans [3]	53	76	84	30.17	30.20	+.10	60.2	−1.4	81	10	68	42	5	52	24	53	49	76	3.38	+.2	4	7.3	ne.	20	ne.	15	16	4	10	4.1	.0	.0
West Gulf States							**56.8**	**−1.9**										**73**	**2.98**	**+0.1**										**6.0**		
Shreveport	249	92	227	30.05	30.24	+.13	54.5	−1.5	80	8	64	31	28	45	34	46	42	75	6.10	+2.4	7	10.1	ne.	24	ne.	10	12	8	10	5.2	.0	.0
Bentonville	1,303	12	51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fort Smith	463	57	82	29.80	30.30	+.19	49.2	−1.8	76	7	58	28	28	41	30	44	38	69	3.84	+1.0	7	5.8	e.	18	s.	10	10	5	15	5.9	.0	.0
Little Rock [2]	357	94	102	29.99	30.28	+.16	50.0	−2.1	76	9	59	29	5	42	33	43	38	76	3.93	−.3	9	6.6	ne.	20	ne.	10	14	2	14	5.3	.0	.0
Austin [2]	605	68	90	29.57	30.24	.....	56.4	−2.1	81	1	66	36	26	47	38	49	45	73	2.26	−.0	8	6.7	n.	21	n.	12	7	7	16	6.6	.0	.0
Brownsville [2]	57	88	96	30.15	30.18	.....	65.0	−2.2	82	8	73	46	14	57	26	57	54	78	.33	−1.6	5	10.1	nw.	23	nw.	12	7	15	8	5.8	.0	.0
Corpus Christi [2]	20	11	78	30.15	30.20	+.13	63.0	−1.3	81	10	70	46	26	56	22	55	50	73	.06	−1.9	2	10.1	n.	25	n.	3	7	5	18	6.7	.0	.0
Dallas [2]	512	220	227	29.73	30.25	.....	54.0	.....	82	1	62	36	28	46	30	46	41	71	4.87	+2.3	8	10.7	n.	33	ne.	18	9	7	14	6.1	.0	.0
Fort Worth [2]	679	92	110	29.50	30.26	+.16	54.4	−1.1	84	1	64	32	28	45	35	46	40	66	2.72	+.1	8	8.0	ne.	26	s.	9	11	4	15	5.8	.0	.0
Galveston [2]	54	106	114	30.19	30.20	+.11	60.6	−2.7	76	10	65	44	27	56	19	54	51	78	2.50	−.8	8	9.0	n.	24	n.	12	12	6	12	5.2	.0	.0
Houston [2]	138	157	190	30.15	30.23	.....	58.8	−2.2	81	10	67	36	28	50	27	51	47	79	3.16	−.7	8	9.7	n.	24	se.	9	7	8	15	6.4	.0	.0
Palestine	510	64	72	.....	30.26	+.15	54.4	−2.8	79	1	63	34	28	46	.....	.....	.....	70	3.57	+.1	10	6.6	ne.	18	ne.	11	10	5	15	.....	.0	.0
Port Arthur	34	59	134	30.18	30.22	.....	58.4	.....	75	10	66	35	28	51	22	52	48	75	4.40	+1.3	10	11.5	n.	29	e.	17	9	8	13	5.7	.0	.0
San Antonio [2]	693	111	301	29.61	30.23	+.15	58.4	−1.9	82	10	68	39	26	49	34	51	45	67	.99	−.9	5	10.9	n.	30	se.	9	8	3	19	6.5	.0	.0

See footnotes at end of table.

TABLE 2.—*Climatological data for Weather Bureau stations, November 1939*—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + Mean min. ÷ 2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
Ohio Valley and Tennessee	*Ft.*	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	*° F.*	*° F.*	*°F.*		*°F.*	*F.*		*° F.*	*° F.*	*° F.*	*° F.*	*%*	*F.*	*In.*		*Miles*							*0–10*	*In.*	*In.*
							44.3	−1.0										73	1.22	−1.9										5.7		
Chattanooga [1]	762	71	214	29.51	30.27	+0.13	50.1	−0.3	73	10	60	31	6	40	35	40	34	72	0.67	−2.7	9	6.2	ne.	23	s.	10	10	4	16	5.9	0.0	0.0
Knoxville [1]	995	66	84	29.20	30.27	+.14	47.0	−.9	72	10	57	27	6	37	37	38	32	70	2.21	−.9	7	4.6	ne.	16	sw.	10	11	5	14	5.6	T	.0
Memphis [1]	399	78	86	29.96	30.27	+.15	49.8	−1.9	76	9	58	31	27	42	27	41	38	80	2.18	−2.1	8	7.0	n.	24	n.	10	11	5	14	5.6	.0	.0
Nashville [1]	546	168	188	29.60	30.27	+.15	47.0	−2.0	72	9	56	28	6	38	37	39	33	67	1.48	−2.0	5	6.9	nw.	26	nw.	10	9	9	12	5.7	T	.0
Lexington	989	6					43.5		68	16	52	26	27	35	29	37	31	68	1.39	−1.9	7	8.3	sw.	24	w.	7	8	7	15	6.2	T	.0
Louisville [1]	525	706	120	29.68	30.28	+.16	44.6	−2.1	67	17	52	29	28	37	31	36	32	75	1.16	−2.4	6	7.3	ne.	35	sw.	10	14	1	15	5.5	T	.0
Evansville	431	76	116	29.81	30.29	+.17	45.3	−1.3	69	15	53	29	27	37	33	39	32	64	1.75	−2.0	6	7.3	n.	29	sw.	10	8	7	15	6.3	T	.0
Indianapolis [1]	823	98	129	29.38	30.28	+.18	42.7	+.4	66	16	50	27	27	36	27	34	30	78	1.15	−2.2	8	7.3	sw.	20	ne.	19	7	9	14	6.2	.3	.0
Terre Haute	575	63	149	29.64	30.28		43.5		68	16	52	26	27	35	29	37	31	68	1.39	−1.9	7	8.3	sw.	24	w.	7	8	7	15	6.2	T	.0
Cincinnati [1]	627	11	51	29.73	30.28	+.16	42.8	+.3	69	17	52	26	27	34	35	35	31	80	.85	−2.0	7	7.1	sw.	22	sw.	10	11	8	11	5.5	T	.0
Columbus [1]	822	90	110	29.35	30.26	+.15	42.1	+.2	67	17	50	27	27	34	29	34	30	77	1.06	−1.7	6	7.8	s.	29	s.	10	12	4	14	5.8	T	.0
Dayton	900	186	213	29.28	30.27		42.0	.0	66	17	50	27	3	34	27	36	31	70	.91	−2.0	5	9.0	sw.	36	sw.	10	11	6	13	5.6	T	.0
Elkins [1]	1,947	65	83	28.10	30.28	+.16	39.4	−.9	75	10	50	15	27	29	49	32	28	78	1.06	−1.7	12	5.4	w.	26	w.	10	10	5	15	5.9	3.0	.0
Parkersburg	637	77	84	29.56	30.27	+.15	42.6	−1.2	75	10	52	23	27	33	37	36	32	75	.72	−1.8	6	5.3	sw.	27	nw.	10	16	4	10	4.5	T	.0
Pittsburgh [1]	1,273	39	54	28.85	30.24	+.14	40.4	−2.8	73	10	48	24	26	32	36	34	29	70	.53	−1.8	8	10.7	w.	43	sw.	10	10	8	12	5.7	T	.0
Lower Lake Region							38.4	−1.0										77	0.92	−1.9									6.3		
Buffalo [1]	768	243	280	29.44	30.22	+.17	38.0	−1.4	64	10	43	24	14	33	25	32	29	79	.53	−2.5	6	14.9	w.	49	w.	10	6	8	16	6.8	.5	.0
Canton	448	10	61	29.68	30.18		31.2	−2.7	60	10	39	7	26	23	35	27	24	79	1.06	−2.1	7	8.6	w.	30	w.	10	11	7	12	5.6	6.7	.0
Ithaca	836	77	109	29.28	30.22		36.8	−1.8	66	10	45	19	20	29	35	31	26	72	.55	−1.8	6	8.4	nw.	29	w.	9	6	8	16	6.5	4.0	.0
Oswego	335	71	85	29.81	30.20	+.15	36.8	−2.1	68	10	43	20	26	30	38	32	27	68	1.08	−2.3	9	9.6	nw.	30	nw.	9	5	5	20	7.3	1.0	.0
Rochester [1]	523	86	102	29.60	30.22	+.17	37.9	−.8	72	10	43	22	14	32	39	32	29	83	.46	−2.1	6	9.1	w.	34	w.	10	5	7	18	7.1	.1	.0
Syracuse [1]	596	65	79	29.74	30.20	+.14	36.8	−1.9	68	10	44	20	14	30	39	30	26	78	1.16	−1.6	8	6.9	w.	20	s.	10	10	6	14	5.9	2.8	.0
Erie	714	57	81	29.44	30.23	+.17	40.0	−1.4	68	10	45	26	20	35	27	36	32	76	2.16	−1.1	9	8.4	s.	26	s.	10	4	8	18	7.2	T	.0
Cleveland [1]	762	267	318	29.35	30.24	+.17	41.8	+.9	69	10	47	28	20	36	30	34	31	78	1.24	−1.4	10	14.6	sw.	47	sw.	10	7	7	16	6.6	.4	.0
Sandusky	629	5	67	29.58	30.25	+.17	41.8	+.7	67	16	49	27	27	35	25				.66	−1.7	9	9.4	sw.	27	sw.	10	9	4	17	6.2	T	.0
Toledo [1]	628	79	87	29.55	30.26	+.19	40.5	+.1	66	16	48	26	26	33	26	34	30	79	.82	−1.6	7	9.9	w.	25	e.	20	12	5	13	5.5	T	.0
Fort Wayne	857	69	84	29.34	30.26		40.0	−.7	66	16	48	25	5	32	27	34	30	79	.73	−2.2	8	8.9	sw.	26	sw.	10	12	6	12	5.4	T	.0
Detroit [1]	626	5	78	29.54	30.23	+.17	38.9	−.4	65	16	47	21	26	31	25	35	31	77	.57	−1.9	6	9.8	w.	29	sw.	10	11	7	12	5.9	T	.0
Upper Lake Region							37.3	+2.3										77	0.69	−1.6									5.8		
Alpena	609	13	89	29.54	30.22	+.21	36.0	+1.6	64	16	42	21	26	30	39	32	29	77	.54	−2.1	6	10.3	nw.	36	se.	9	5	6	19	7.2	.7	.0
Escanaba	612	54	72	29.56	30.24	+.21	35.2	+2.1	63	16	42	22	10	28	30	32	28	78	.81	−1.3	7	9.6	nw.	28	s.	9	8	8	14	6.0	.8	.0
Grand Rapids [1]	707	70	244	29.46	30.23	+.18	40.1	+1.7	60	10	48	24	26	33	30	33	30	82	.76	−2.0	6	10.8	sw.	43	sw.	10	10	7	13	5.3	.8	.0
Lansing	878	5	90	29.27	30.24		37.4	−.1	61	17	45	22	26	29	26	34	31	83	.65	−1.8	6	8.6	sw.	23	sw.	10	11	7	12	5.3	.5	.0
Ludington	637	60	66																												
Marquette	734	44	69	29.39	30.22	+.20	36.3	+3.0	62	15	42	23	11	30	26	32	29	79	.79	−2.1	4	6.1	w.	18	s.	9	8	10	12	5.8	8.2	.0
Sault Sainte Marie [1]	724	5	33	29.40	30.22	+.21	31.8	−.2	47	16	38	17	14	25	21	29	27	84	1.42	−1.2	6	8.5	nw.	34	nw.	10	4	2	24	8.2	3.1	.0
Chicago	673	7	131	29.52	30.27	+.20	41.6	+1.5	64	16	48	26	11	35	30	37	31	69	.95	−1.4	8	10.5	sw.	26	nw.	10	11	5	14	5.5	.4	.0
Green Bay	617	109	141	29.54	30.24	+.20	37.6	+3.6	64	16	45	20	11	30	30	32	27	70	.45	−1.7	5	9.3	w.	28	sw.	10	10	9	11	5.4	T	.0
Milwaukee [1]	681	97	221	29.48	30.26	+.21	41.2	+3.9	68	16	48	24	11	34	32	34	29	74	.33	−1.4	6	12.1	w.	32	s.	9	10	8	12	5.5	T	.0
Duluth	1,133	5	47	28.95	30.21	+.17	35.6	+5.6	64	15	44	10	11	28	36	30	26	76	.16	−1.3	3	11.5	w.	35	nw.	7	16	5	9	4.2	1.5	.0
North Dakota							35.1	+8.4										68	0.07	−0.6									4.3		
Moorhead, Minn.	940	50	58	29.19	30.20	+.13	34.9	+7.8	66	14	47	9	10	23	39	29	23	69	.09	−.8	4	7.9	s.	26	nw.	9	16	5	9	4.4	.1	.0
Bismarck [1]	1,677	8	57	28.38	30.21	+.14	36.4	+7.9	69	13	50	10	10	23	43	28	21	65	.01	−.6	1	7.6	se.	28	w.	9	12	11	7	4.7	.1	.0
Devils Lake	1,478	11	44	28.55	30.17	+.11	33.9	+9.4	69	14	46	5	10	22	41	28	27	71	.09	−.6	3	8.7	s.	31	nw.	9	9	10	11	5.6	T	.0
Lemmon, S. Dak.	2,602	4	38																												
Grand Forks	832	11	71				33.4	+7.4	66	15	45	7	10	21	39	29	25		.12	−.7	2	9.5	se.							.1	.0
Williston	1,878	42	50	28.12	30.16	+.10	36.8	+9.6	63	14	49	6	10	24	36	30	23	65	.04	−.5	1	6.5	s.	39	nw.	9	21	7	2	2.4	T	.0
Upper Mississippi Valley							41.4	+2.7										71	1.05	−1.0									5.1		
Minneapolis-St. Paul, Minn. [1]	838	32	61	29.30	30.24	+.18	37.6	+5.2	64	17	48	18	10	27	36	31	25	68	.02	−1.2	2	8.8	sw.	33	nw.	10	16	7	7	3.9	T	.0
Springfield, Minn.	1,025	4	42																												
La Crosse [1]	714	11	48	29.51	30.26	+.19	38.1	+2.9	69	17	47	19	27	29	34	31	27	78	.29	−1.3	6	5.3	s.	18	w.	10	14	8	8	4.4	.5	.0
Madison	974	70	78	29.30	30.27	+.21	39.2	+4.0	68	16	46	23	11	32	29	33	29	76	.29	−1.5	6	8.4	s.	24	s.	9	13	6	11	5.1	T	.0
Charles City	1,015	10	51	29.15	30.28	+.20	38.0	+5.0	70	17	50	16	27	26	39	31	26	71	.59	−.9	3	5.5	se.	21	se.	9	17	5	8	3.7	T	.0
Davenport	606	66	161	29.61	30.29	+.21	41.8	+2.8	68	16	50	24	28	34	29	36	30	69	.94	−.9	6	9.3	sw.	27	sw.	9	11	9	10	5.2	.0	.0
Des Moines [1]	860	5	99	29.20	30.27	+.19	41.6	+3.2	70	9	52	19	28	31	32	35	29	69	.47	−1.0	4	8.3	sw.	34	s.	9	15	7	8	4.2	.0	.0
Dubuque	699	60	79	29.50	30.28	+.21	40.4	+3.4	69	15	49	21	28	32	32	34	29	70	1.09	−.6	5	5.7	nw.	19	nw.	10	10	12	8	5.2	T	.0
Keokuk	614	64	78	29.62	30.29	+.20	43.0	+1.9	70	9	51	25	28	35	31	37	31	68	1.70	−.2	8	6.8	sw.	24	nw.	7	12	5	13	5.6	T	.0
Cairo	358	87	93	29.90	30.29	+.17	46.6	−.7	73	9	55	29	22	38	33	40	34	67	2.22	−1.5	6	7.4	n.	21	n.	10	8	6	16	6.1	.0	.0
Peoria [1]	609	11	45	29.55	30.28	+.19	41.2	+3.7	67	15	51	20	28	32	32	35	31	77	1.14	−1.2	9	5.6	s.	17	s.	9	11	8	11	5.1	T	.0
Springfield, Ill. [1]	636	5	191	29.61	30.29	+.19	43.4	+1.2	67	9	52	26	27	35	31	35	31	79	1.46	−1.1	8	10.2	s.	27	n.	10	8	7	15	6.3	T	.0
St. Louis [1]	568	179	303	29.67	30.29	+.19	45.4	.0	71	9	52	30	28	38	27	39	32	62	2.43	−.4	8	9.6	sw.	38	sw.	9	10	6	14	6.0	.0	.0
Missouri Valley							42.4	+2.8										66	1.43	0.0									4.5		
Columbia, Mo. [1]	784	6	66	29.44	30.30	+.21	43.5	+.2	75	9	53	22	28	34	40	37	32	72	4.00	+1.8	9	6.6	n.	22	sw.	9	8	10	12	6.0	.0	.0
Kansas City [1]	750	38	76	29.46	30.30	+.21	43.8	+.1	72	9	53	22	3	35	33	39	33	71	2.45	+.6	7	8.3	sw.	37	sw.	9	13	6	11	5.4	.0	.0
St. Joseph [1]	967	11	49	29.39	30.29		44.4	+2.9	74	9	53	21	2	36	30	37	33	79	2.73	+1.2	5	6.9	s.	26	sw.	9	14	6	10	4.5	T	.0
Springfield, Mo. [1]	1,324	5	78	28.84	30.30	+.20	44.6	−1.1	73	9	53	24	28	36	31	37	32	76	2.77	.0	10	7.0	s.	24	sw.	9	8	5	17	6.3	T	.0
Topeka	987	65	87	29.21	30.29		44.9	+2.1	74	9	55	23	2	35	32	39	32	67	1.42	−.1	4	7.8	s.	30	sw.	9	13	7	10	4.9	T	.0
Lincoln [1]	1,189	11	81	29.97	30.28	+.20	43.0	+3.9	71	9	54	19	27	32	36	32	24	59	.52	−.6	1	8.2	s.	29	sw.	9	17	5	8	3.9	T	.0
Omaha [1]	982	31	44	29.20	30.28	+.20	41.6	+3.1	72	9	53	16	3	30	35	34	27	64	.35	−.7	2	8.9	s.	31	sw.	9	17	4	9	4.0	T	.0
Valentine	2,598	47	54	27.46	30.25	+.17	40.0	+5.4	72	13	55	12	2	25	45	31	22	57	T	−.6	0	8.3	w.	25	s.	8	20	5	5	3.3	T	.0
Sioux City	1,138	64	106	29.01	30.26	+.18	40.2	+5.0	73	16	53	15	27	27	46	32	24	57	.03	−1.0	1	7.5	s.	26	nw.	23	17	4	9	3.6	T	.0
Huron [1]	1,289	27	41	28.82	30.24	+.16	37.7	+6.2	71	14	52	16	21	23	47	30	22	61	T	−.6	0	11.4	se.	37	se.	8	20	3	7	3.2	T	.0
Northern Slope							38.6	+5.9										58	0.10	−0.6									4.0		
Billings	3,140	5		26.44	30.18		42.6		69	3	56	14	26	29	40	33	20	44	.05		1	11.6	sw.	56	nw.	30	18	3	9	3.8	.0	.0
Havre	2,507	11	67	27.43	30.12	+.09	40.8	+9.6	67	16	55	12	27	26	38	33	24	57	.18	−.4	3	9.8	sw.	39	w.	22	13	9	8	4.5	.0	.0
Helena	4,124	85	111	25.94	30.21	+.11	39.2	+6.0	64	8	50	23	5	29	35	32	23	56	.05	−.7	3	5.8	sw.	32	nw	8	11	4	15	5.5	T	.0
Missoula	3,263	80	91				36.6	+3.1	58	11	47	19	29	26	26	30	27	84	.14	−1.1	2	4.3	se.	26	w.	8	13	9	8	4.8	T	.0
Kalispell	2,973	48	56	27.10	30.23	+.16	35.4	+3.0	54	8	43	19	25	27	26	32	29	81	.59	−.8	6	4.1	nw.	29	w.	8	3	7	20	7.5	T	.0
Miles City [1]	2,371	48	55	27.37	30.19	+.12	39.9	+9.0	67	14	55	12	28	25	40	31	22	56	.03	−.5	1	6.2	s.	36	w.	30	17	7	6	3.6	.0	.0
Rapid City [1]	3,259	50	58	26.82	30.22	+.14	43.8	+7.9	70	22	56	19	2	32	36	31	19	46	T	−.5	0	8.8	w.	32	nw.	23	21	6	3	2.4	.0	.0
Cheyenne [1]	6,144	5	39	24.10	30.26	+.19	37.9	+3.1	65	22	54	8	26	22	43	28	17	50	.06	−.5	1	9.1	nw.	30	nw.	30	16	9	5	3.6	1.2	.0
Lander	5,352	60	68	24.80	30.25	+.15	36.0	+5.7	64	8	52	9	26	20	40	27	17	51	.00	−.6	0	3.6	sw.	22	w.	8	14	14	2	3.2	.0	.0
Sheridan	3,790	10	47	26.24	30.24		38.2		68	14	57	5	26	19	48	27	17	54	T	−.6	0	3.8	s.	25	nw.	4	22	7	1	2.0	.0	.0
Yellowstone Park	6,235	12	46	24.05	30.34	+.23	36.0	+6.9	58	3	49	15	17	23	33	27	17	52	T	−.7	0	7.1	sw.	28	sw.	8	15	8	7	3.8	T	T
North Platte [1]	2,821	11	51	27.30	30.28	+.20	40.9	+4.3	73	14	56	15	2	25	45	29	21	62	T	−.5	0	6.5	n.	21	n.	23	20	1	9	3.3	T	.0

See footnotes at end of table.

TABLE 2.—*Climatological data for Weather Bureau stations, November 1939*—Continued

District and station	Elevation of instruments: Barometer above sea level	Thermometer above ground	Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Sea level, reduced to mean of 24 hours	Departure from normal	Temperature of the air: Mean max. + mean min. ÷ 2	Departure from normal	Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Departure from normal	Days with 0.01 inch or more	Wind: Average hourly velocity	Prevailing direction	Maximum velocity: Miles per hour	Direction	Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles								0-10	In.	In.
Middle Slope							45.1	+2.3										57	0.51	−0.4										3.7		
Denver [2]	5,292	106	113	24.85	30.23	+0.17	43.8	+4.0	70	22	56	19	26	32	34	31	19	47	0.01	−0.5	1	7.0	s.	23	ne.	9	18	8	4	3.0	T	0.0
Pueblo [2]	4,690	79	86	25.34	30.25	+.20	41.8	+2.4	73	4	58	15	25	26	52	30	20	54	.51	+.2	3	4.9	nw.	18	se.	9	19	8	3	2.6	T	.0
Concordia	1,392	50	58	28.77	30.28	+.20	44.3	+2.9	70	9	55	17	2	33	33	36	27	58	.48	−.5	2	7.1	sw.	26	sw.	9	18	6	6	3.6	T	.0
Dodge City	2,509	10	86	27.60	30.26	+.19	45.0	+2.4	74	7	58	13	3	32	40	35	25	52	.42	−.3	3	10.0	s.	28	sw.	28	18	2	10	3.5	1.0	.0
Wichita [2]	1,358	85	93	28.77	30.28	+.20	46.2	+1.4	71	7	56	19	3	36	35	38	31	65	.81	−.6	6	8.6	s.	30	sw.	9	16	2	12	4.6	.0	.0
Oklahoma City [2]	1,214	10	47	28.87	30.28	+.20	49.6	+.8	79	8	59	21	3	40	32	41	34	65	.84	−1.0	6	7.2	s.	23	nw.	10	12	6	12	5.1	.0	.0
Chadron, Nebr.	3,439	4	58	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Southern Slope							51.0	−0.7										62	1.00	−0.1										5.2		
Abilene [2]	1,738	10	56	28.39	30.24	+.17	52.7	−.8	81	1	63	33	26	43	38	44	37	66	1.99	+.6	8	7.2	n.	27	s.	9	12	4	14	5.6	.0	.0
Amarillo [2]	3,676	10	49	26.52	30.25	+.20	48.3	+2.8	81	1	60	24	3	36	35	34	25	56	.06	−.9	2	8.0	s.	24	w.	9	16	7	7	3.8	.0	.0
Del Rio	960	63	71	29.20	30.20	+.15	57.0	−3.0	78	8	65	41	4	49	29	50	45	70	1.59	+.4	7	7.3	se.	24	se.	9	4	8	18	7.3	.0	.0
Roswell	3,566	75	85	26.56	30.24	+.21	46.2	−1.9	81	1	60	23	14	33	46	38	28	57	.38	−.5	2	6.2	s.	30	w.	9	17	4	9	4.0	T	.0
Southern Plateau							51.4	+3.0										54	0.67	0.0										3.8		
El Paso [2]	3,778	82	101	26.19	30.15	+.15	51.5	−1.2	80	1	62	34	13	41	38	42	33	56	.75	+.2	5	8.1	e.	25	ne.	24	12	8	10	5.0	.0	.0
Albuquerque [1]	5,314	5	39	24.88	30.17	----	44.2	+.9	71	1	56	24	19	32	36	35	25	52	.78	+.3	3	7.6	ne.	36	e.	2	18	3	9	3.8	T	.0
Santa Fe	7,013	38	53	23.37	30.22	+.19	40.6	+1.7	64	1	52	22	3	29	31	31	20	50	.74	+.1	4	4.9	e.	17	n.	30	19	3	8	3.4	1.3	1.0
Flagstaff	6,907	10	59	23.44	30.08	+.06	40.0	+5.4	69	1	55	18	21	25	41	32	25	62	1.45	.0	5	6.2	e.	19	w.	9	17	4	9	----	1.5	T
Phoenix [2]	1,107	39	51	28.85	30.01	+.03	64.3	+4.6	89	1	78	43	30	51	38	50	40	52	.75	.0	2	5.0	e.	19	w.	28	13	10	7	4.2	.0	.0
Yuma	141	9	54	29.86	30.02	+.04	66.5	+4.1	89	1	79	45	30	54	33	54	44	51	.19	−.1	3	5.0	n.	18	n.	20	21	4	5	2.8	.0	.0
Independence	3,957	5	26	26.08	30.14	+.09	52.4	+5.2	78	1	68	46	25	36	41	----	----	----	.00	−.3	0	----	----	----	----	----	----	----	----	----	----	----
Middle Plateau							43.3	+4.0										56	0.15	−0.6										3.1		
Reno [2]	4,527	62	76	25.71	30.19	+.08	45.0	+3.5	72	2	61	22	9	29	40	34	25	61	.06	−.6	2	4.4	w.	20	w.	25	23	4	3	2.2	.0	.0
Tonopah	6,090	12	20	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Winnemucca	4,344	18	56	25.76	30.22	+.08	41.0	+2.6	71	1	59	16	21	23	47	32	20	51	.16	−.5	2	6.3	ne.	17	s.	25	16	8	6	3.6	T	.0
Modena	5,473	10	46	24.74	30.15	+.07	40.4	+4.0	69	1	57	14	19	24	43	32	21	52	.22	−.4	4	7.6	w.	21	sw.	3	18	4	8	4.0	.0	.0
Salt Lake City [1]	4,227	32	46	25.90	30.22	+.10	46.0	+4.9	69	3	57	29	10	35	32	35	28	63	T	−1.4	0	5.4	se.	24	nw.	9	18	6	6	3.4	.0	.0
Grand Junction	4,602	60	68	25.54	30.17	+.09	44.2	+4.9	67	2	58	22	30	30	33	35	24	51	.30	−.3	1	4.7	se.	17	ne.	9	24	2	4	2.1	.0	.0
Northern Plateau							41.1	+2.1										68	0.11	−1.3										5.5		
Baker	3,471	36	54	26.72	30.28	+.12	39.2	+3.2	63	1	53	19	4	26	35	28	21	67	T	−1.0	0	6.2	se.	15	w.	8	11	9	10	5.2	.0	.0
Boise [2]	2,739	79	87	27.40	30.27	+.10	42.4	+1.4	69	13	54	22	9	30	37	34	28	71	.13	−1.2	1	3.6	se.	18	se.	25	14	7	9	4.5	.0	.0
Pocatello [1]	4,478	5	31	25.65	30.27	+.13	38.6	+1.9	68	3	55	11	18	22	42	30	21	57	.02	----	1	5.4	sw.	23	w.	8	14	8	8	4.1	.0	.0
Spokane [2]	1,929	101	110	28.09	30.21	+.11	39.6	+1.1	57	11	48	24	17	31	26	37	33	77	.28	−1.8	5	5.0	n.	30	sw.	8	7	12	11	6.1	.0	.0
Walla Walla	991	57	65	29.11	30.19	+.06	45.3	+2.5	65	8	54	27	28	37	28	40	34	65	.11	−1.9	3	4.6	se.	26	sw.	8	7	10	13	6.4	.0	.0
Yakima	1,076	58	67	29.03	30.20	----	41.3	+2.4	63	30	54	24	28	29	34	37	31	68	.01	−.8	1	3.5	se.	28	w.	8	7	8	15	6.5	.0	.0
North Pacific Coast Region							49.5	+3.6										83	3.31	−3.1										7.7		
North Head	211	8	56	29.90	30.13	+.08	52.0	+3.8	67	24	56	42	8	48	15	49	47	87	3.73	−4.7	16	15.5	s.	48	s.	13	2	8	20	8.2	.0	.0
Seattle [2]	125	90	321	30.09	30.13	+.09	51.0	+5.4	63	16	56	39	20	46	21	46	43	83	2.75	−2.3	12	9.4	s.	31	s.	10	3	9	18	7.6	.0	.0
Tacoma	263	172	201	29.91	30.13	+.09	49.6	+5.0	63	7	56	37	28	43	22	----	----	----	2.67	−3.6	15	6.7	s.	26	nw.	8	2	7	21	8.1	.0	.0
Tatoosh Island	86	9	55	29.95	30.05	+.08	51.4	+5.5	62	23	54	44	7	49	11	49	47	87	11.91	.0	24	18.5	s.	53	s.	10	0	5	5	9.1	.0	.0
Medford [1]	1,329	29	58	28.76	30.19	----	44.6	+.8	68	1	58	22	28	31	38	40	35	72	.06	−2.4	3	----	sw.	----	----	----	8	12	10	5.4	.0	.0
Portland, Oreg. [2]	154	68	106	30.12	30.16	+.06	50.0	+3.2	66	7	56	35	10	44	21	46	44	85	1.73	−4.4	10	5.1	se.	20	s.	29	3	7	20	7.6	.0	.0
Roseburg	510	45	76	29.62	30.18	+.06	47.6	+1.7	71	7	56	32	10	40	34	46	43	84	.34	−4.3	5	3.0	nw.	13	sw.	25	0	14	16	7.6	.0	.6
Middle Pacific Coast Region							56.2	+2.5										64	0.34	−3.1										4.1		
Eureka	60	72	88	30.09	30.16	+.05	50.4	−.7	65	30	57	40	4	44	20	48	46	86	.91	−4.3	4	5.1	se.	23	n.	3	5	10	15	6.5	.0	.0
Redding [1]	722	20	34	29.32	30.10	----	59.4	+5.3	85	1	71	41	29	48	28	46	31	37	.16	−4.2	1	7.8	nw.	21	nw.	3	13	10	7	4.4	.0	.0
Sacramento [2]	66	92	115	30.06	30.09	.00	56.0	+2.4	81	1	70	35	27	42	35	47	38	58	.07	−1.8	1	4.8	n.	18	sw.	25	24	5	1	1.7	.0	.0
San Francisco	155	112	132	29.92	30.09	.00	59.2	+2.9	78	6	67	49	27	51	26	52	48	73	.20	−2.2	1	5.4	w.	24	se.	25	16	8	6	3.8	.0	.0
South Pacific Coast Region							62.2	+3.9										62	0.56	−0.4										3.3		
Fresno [1]	327	97	105	24.78	30.09	+.03	55.7	+1.5	79	1	70	34	30	41	41	48	41	62	.04	----	1	3.5	nw.	22	nw.	25	19	8	3	2.7	.0	.0
Los Angeles	338	159	191	29.67	30.03	+.01	67.1	+6.2	87	23	77	52	27	57	30	55	45	54	.08	−1.1	1	5.3	ne.	14	ne.	24	18	10	2	2.8	.0	.0
San Diego [2]	87	62	70	29.99	30.02	.00	63.8	+4.1	86	22	72	51	30	56	30	56	51	70	1.04	+.3	4	5.1	nw.	18	n.	27	13	9	8	4.5	.0	.0
West Indies																																
San Juan, P. R.	82	9	54	29.83	29.91	----	79.2	+.8	89	5	84	70	30	74	14	----	----	----	6.87	+.1	19	10.5	e.	36	n.	29	3	23	4	5.5	.0	.0
Panama Canal																																
Balboa Heights	118	6	92	----	[3]29.81	−.01	79.3	+.2	90	30	85	71	10	74	17	----	----	[3]85	6.55	−3.9	22	5.8	nw.	27	n.	24	0	17	13	7.2	.0	.0
Cristobal	36	6	97	----	[3]29.82	−.01	80.2	+.9	89	22	84	74	10	76	13	76	74	[3]86	35.18	+12.8	24	9.7	w.	33	w.	6	0	8	22	8.2	.0	.0
Alaska																																
Fairbanks	454	11	87	----	[4]29.76	----	−5.2	−8.3	23	1	3	−36	27	−13	40	−4	−8	79	.63	−.1	11	3.9	n.	18	ne.	1	6	6	18	7.1	11.7	13.4
Juneau	80	96	116	[4]29.55	[4]29.64	----	38.3	+2.9	55	1	43	27	9	34	17	36	32	79	13.14	+4.6	25	8.3	se.	30	e.	24	1	2	27	9.2	5.1	1.2
Nome	22	5	57	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Hawaiian Islands																																
Honolulu	38	86	100	29.97	30.01	----	74.0	−.5	81	20	78	68	28	70	10	67	64	73	4.41	+.6	23	10.1	e.	26	e.	24	4	16	10	6.3	.0	.0

[1] Observations taken at airport.
[2] Data are airport records.
[3] Barometric and hygrometric data from airport, other data city-office records.
[3] Observations taken bi-hourly.
[4] Pressure not reduced to mean of 24 hours.

NOTE—Except as indicated by notes 1 and 2, data in table 2 are city office records.

TABLE 3.—*Data furnished by the Canadian Meteorological Service, November 1939*

Stations	Altitude above mean sea level Jan. 1, 1919	Pressure			Temperature of the air						Precipitation		
		Station reduced to mean of 24 hours	Sea level reduced to mean of 24 hours	Departure from normal	Mean max.+ mean min. ÷2	Departure from normal	Mean maximum	Mean minimum	Highest	Lowest	Total	Departure from normal	Total snowfall
	Feet	*In.*	*In.*	*In.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*In.*	*In.*	*In.*
Cape Race, Newfoundland	99				35.3	−2.1	41.1	29.5	53	19	2.10	−3.49	T
Sydney, Cape Briton Island	48	29.78	29.91	−0.05	37.4	−1.0	42.7	32.2	63	25	2.09	−2.99	1.6
Halifax, Nova Scotia*	83		29.99	.00	37.6		43.7	31.5	55	24	1.95		.1
Yarmouth, Nova Scotia	65	29.92	30.03	+.03	37.8	−2.4	43.4	32.2	55	21	1.17	−2.87	.2
Charlottetown, Prince Edward Island	38	29.88	29.97	+.01	34.8	−1.2	39.8	29.8	59	22	1.43	−1.96	2.5
Chatham, New Brunswick	28	29.86	29.97	−.01	30.7	−1.5	38.5	22.9	59	3	.94	−2.44	4.2
Father Point, Quebec	20	30.02	30.03	+.07	29.2	−.2	34.3	24.1	49	9	.33	−3.01	1.4
Quebec, Quebec	296												
Doucet, Quebec	1,236	28.75	30.16	+.16	19.6	−4.2	28.5	10.8	42	−13	.45	−2.14	1.5
Montreal, Quebec	187	29.94	30.16	+.14	32.6	−.5	37.9	27.4	52	14	1.58	−1.89	1.0
Ottawa, Ontario	236	29.80	30.18	+.16	30.1	−2.2	38.6	21.6	56	10	1.06	−1.64	3.1
Kingston, Ontario	285	29.89	30.21	+.17	33.6	−2.8	41.4	25.8	60	12	.79	−2.13	3.6
Toronto, Ontario	379	29.80	30.22	+.17	36.9	−.7	43.4	30.4	62	20	.32	−2.44	T
Cochrane, Ontario	930				23.6	+.2	31.1	16.2	46	−6	.73	−1.37	4.3
White River, Ontario	1,244	28.82	30.20	+.21	25.9	+3.2	35.8	16.0	48	−5	.49	−1.97	3.4
London, Ontario	808	29.33	30.23		35.0	−1.8	43.2	26.8	60	17	.99	−2.44	1.3
Southampton, Ontario	656	29.48	30.19	+.17	35.4	−1.3	43.1	27.7	53	13	1.63	−1.92	.5
Parry Sound, Ontario	688	29.51	30.21	+.20	32.1	−1.6	39.6	24.6	52	6	1.22	−2.86	.3
Port Arthur, Ontario	644	29.48	30.22	+.20	31.4	+4.2	39.7	23.0	52	8	.32	−1.20	.8
Winnipeg, Manitoba	760	29.27	30.16	+.07	31.0	+9.2	41.6	20.5	61	5	.06	−1.02	.2
Minnedosa, Manitoba	1,690	28.28	30.15	+.10	31.2	+9.5	42.2	20.1	60	−2	.03	−.87	.2
La Pas, Manitoba	860	29.08	30.08	+.10	23.9	+6.5	33.1	14.7	51	−15	.72	−.08	3.5
Qu'Appelle, Saskatchewan	2,115				32.8	+10.4	42.8	22.7	61	−3	.17	−.84	.4
Moose Jaw, Saskatchewan	1,759				37.0	+12.8	48.2	25.8	65	3	.15	−.47	.8
Swift Current, Saskatchewan	2,392	27.22	30.09	+.03	38.3	+12.2	49.6	27.0	64	3	.05	−.51	T
Medicine Hat, Alberta	2,365	27.51	30.04	.00	42.0	+12.0	56.9	27.1	68	11	.01	−.68	.1
Calgary, Alberta	3,540	26.31	30.05	.00	40.1	+13.7	51.8	28.4	63	15	.23	−.51	2.0
Banff, Alberta	4,521				35.8	+11.9	43.1	28.4	52	15	1.06	−.39	T
Prince Albert, Saskatchewan	1,450	28.46	30.08	+.04	25.6	+7.0	36.0	15.3	54	−18	.90	+.02	8.2
Battleford, Saskatchewan	1,592												
Edmonton, Alberta	2,150	27.56	29.96		33.6	+7.9	42.2	25.0	51	12	.49	−.20	3.5
Kamloops, British Columbia	1,262	28.72	30.09	+.07	43.5	+7.9	49.3	37.7	58	28	.53	−.39	.0
Victoria, British Columbia	230	29.83	30.08	+.02	48.4	+3.8	52.2	44.7	59	42	4.17	−.90	.0
Barkerville, British Columbia	4,180												
Estevan Point, British Columbia	20	29.98	30.00	.00	49.6	+4.4	53.4	45.7	60	37	31.74	+19.73	.0
Prince Rupert, British Columbia	170	29.57	29.76	−.07				39.6		33	18.63	+5.90	.0
St. George's, Bermuda	151												

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Cape Race, N. F.	99				46.4	+0.6	52.2	40.6	61	25	8.43	+5.08	0.0
Quebec, Quebec	296	29.62	29.95	−0.06	44.6	+1.1	51.1	38.1	69	22	4.77	+1.30	.8
Montreal, Quebec	187	29.77	29.98	−.04	47.0	+.4	54.2	39.7	71	21	3.58	+.30	T
Calgary, Alberta	3,540	26.29	30.03	+.04	36.5	−5.4	47.5	25.5	68	−8	2.97	+2.32	16.1
Banff, Alberta	4,521				37.0	−1.7	45.6	28.5	63	−7	3.96	+2.87	30.0
Battleford, Saskatchewan	1,592	28.17	29.94	−.04	37.2	−2.8	48.0	26.3	70	0	.44	−.15	3.9
Kamloops, British Columbia	1,262	28.69	30.05	+.02	46.0	−1.6	53.6	38.4	70	20	.92	+.27	2.0
Estevan Point, British Columbia	20	30.06	30.09	+.10	49.5	−.3	54.3	44.7	61	33	12.42	+1.02	.0
Prince Rupert, British Columbia	170	29.76	29.95	+.06	46.6	−.6	51.9	41.4	60	30	14.69	+2.37	.0

TABLE 4.—*Severe local storms, November 1939*

[Compiled by Mary O. Souder from reports submitted by Weather Bureau Officials]

[The table herewith contains such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meteorological Yearbook]

*Observations taken at Royal Canadian Air Force Station.

No severe local storms reported for November 1939.

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Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, November 1939

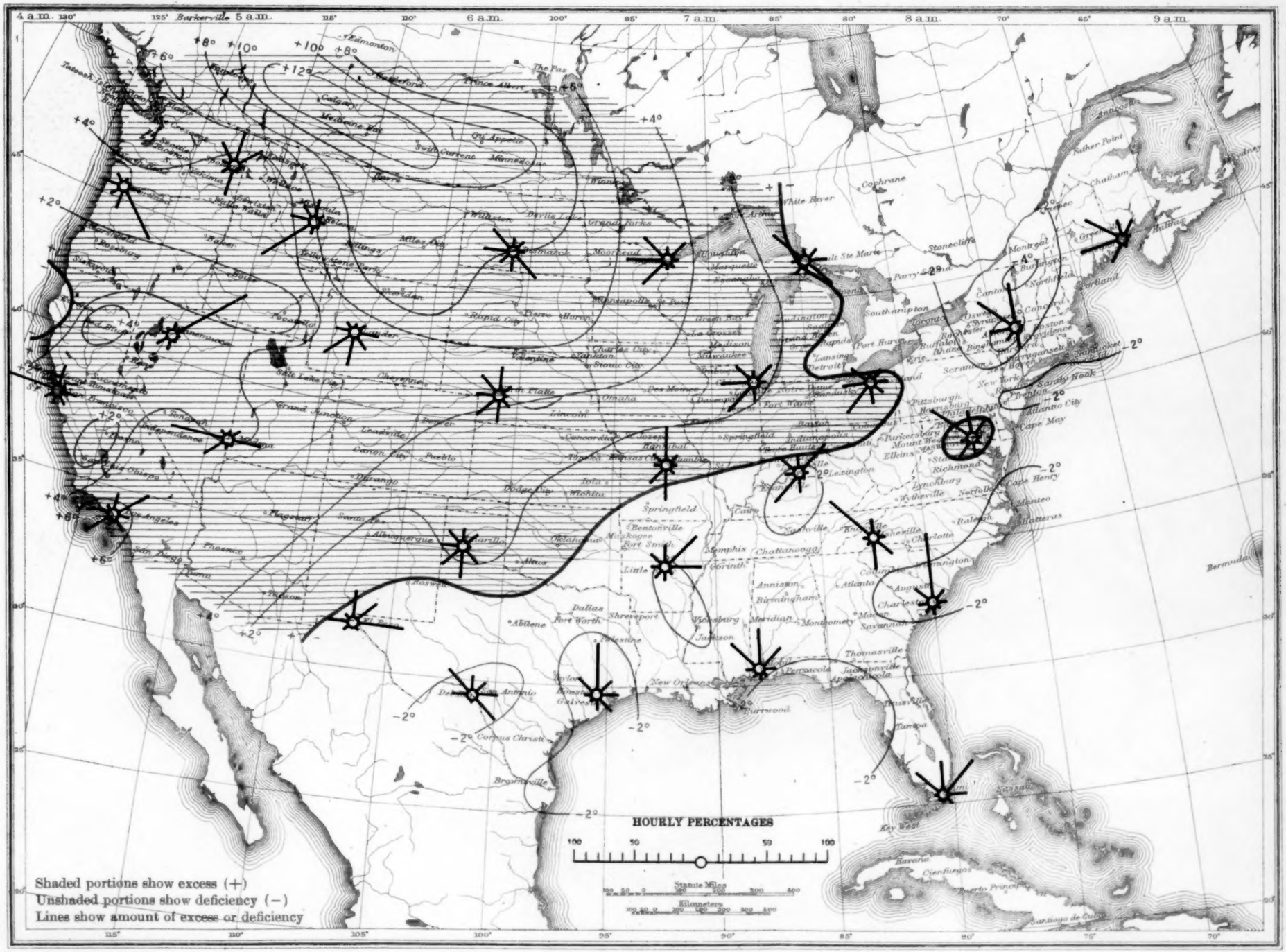
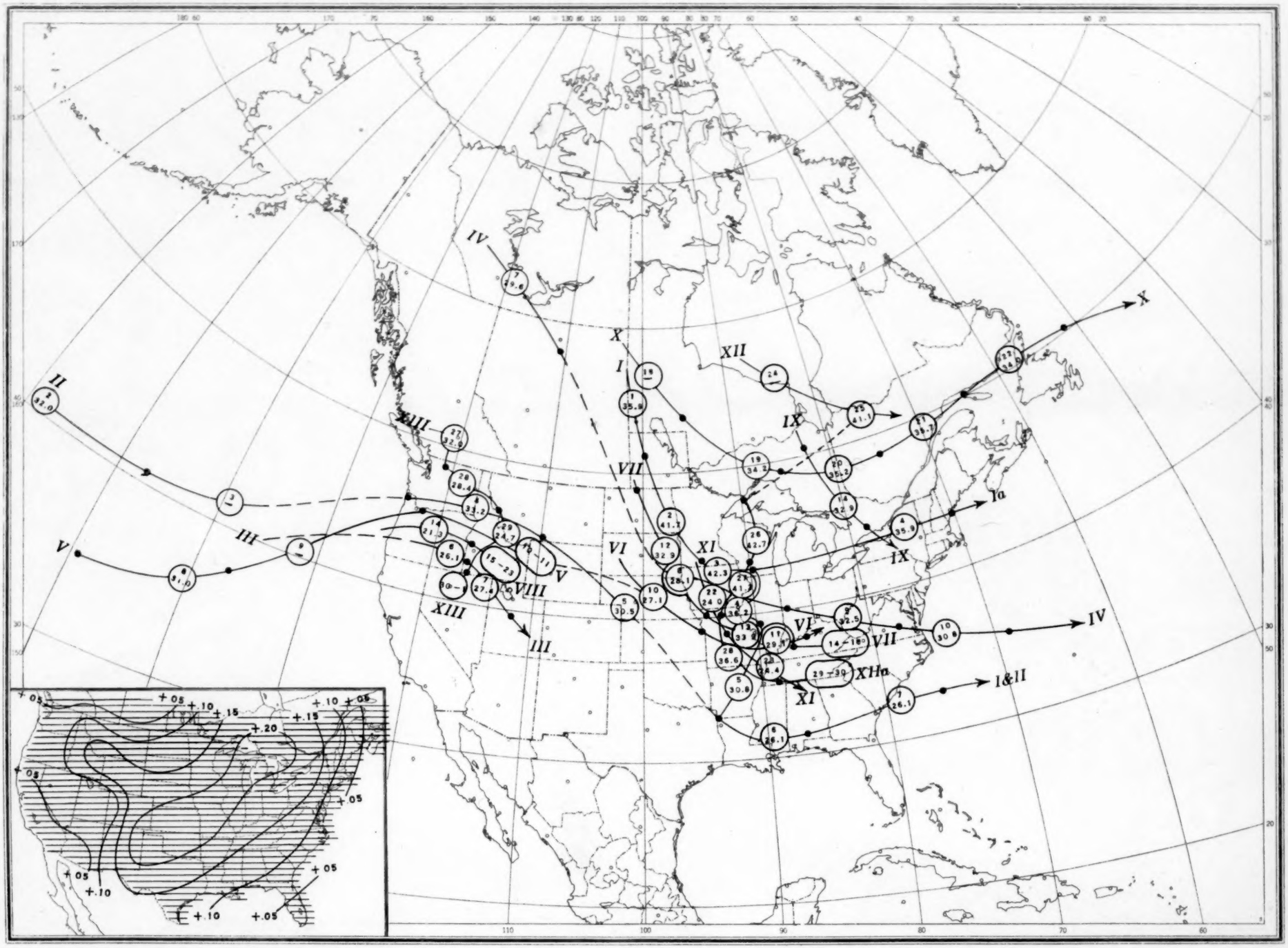


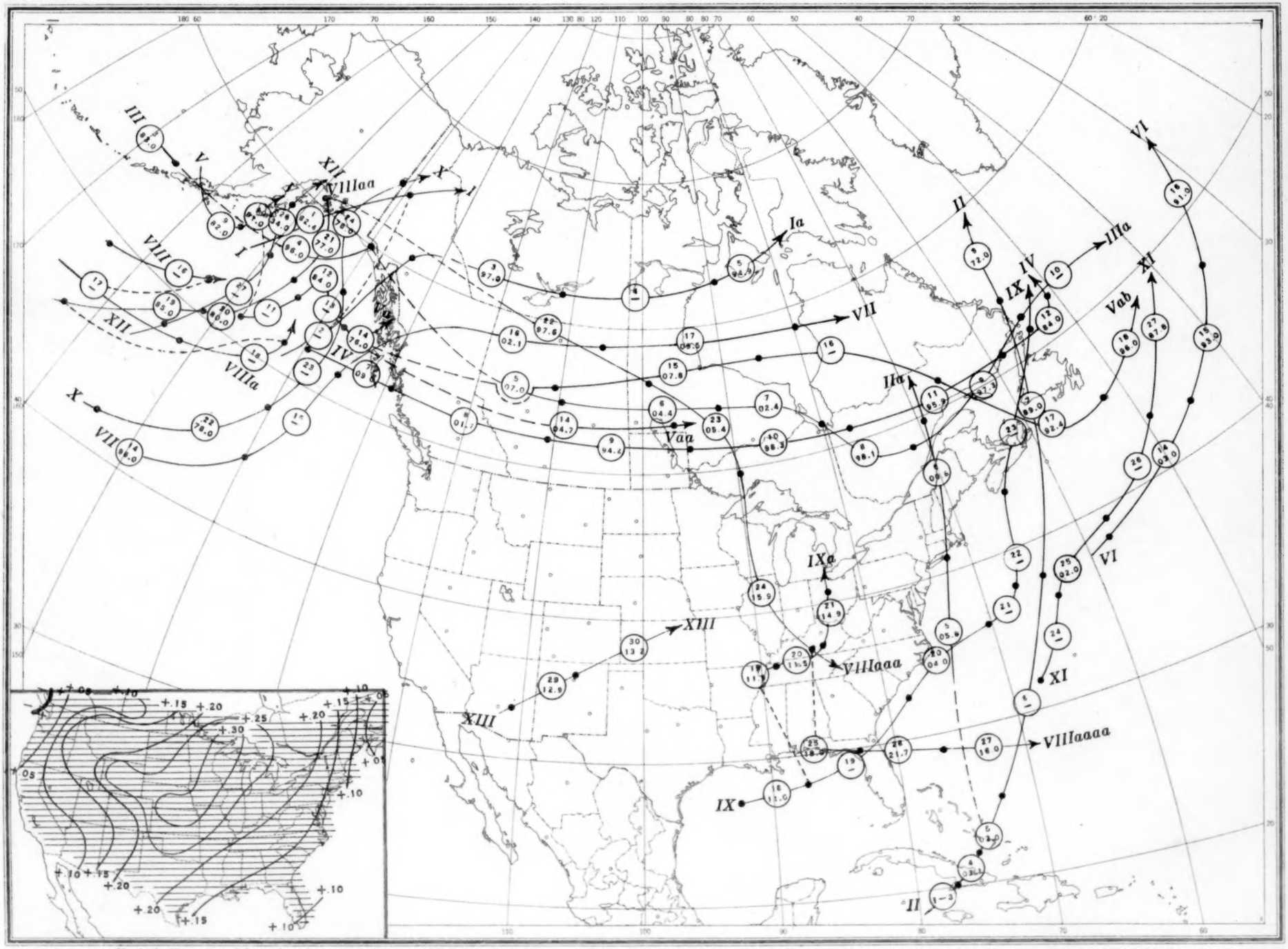
Chart II. Tracks of Centers of Anticyclones, November 1939. (Inset) **Departure of Monthly Mean Pressure from Normal**



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, November 1939. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, November 1939

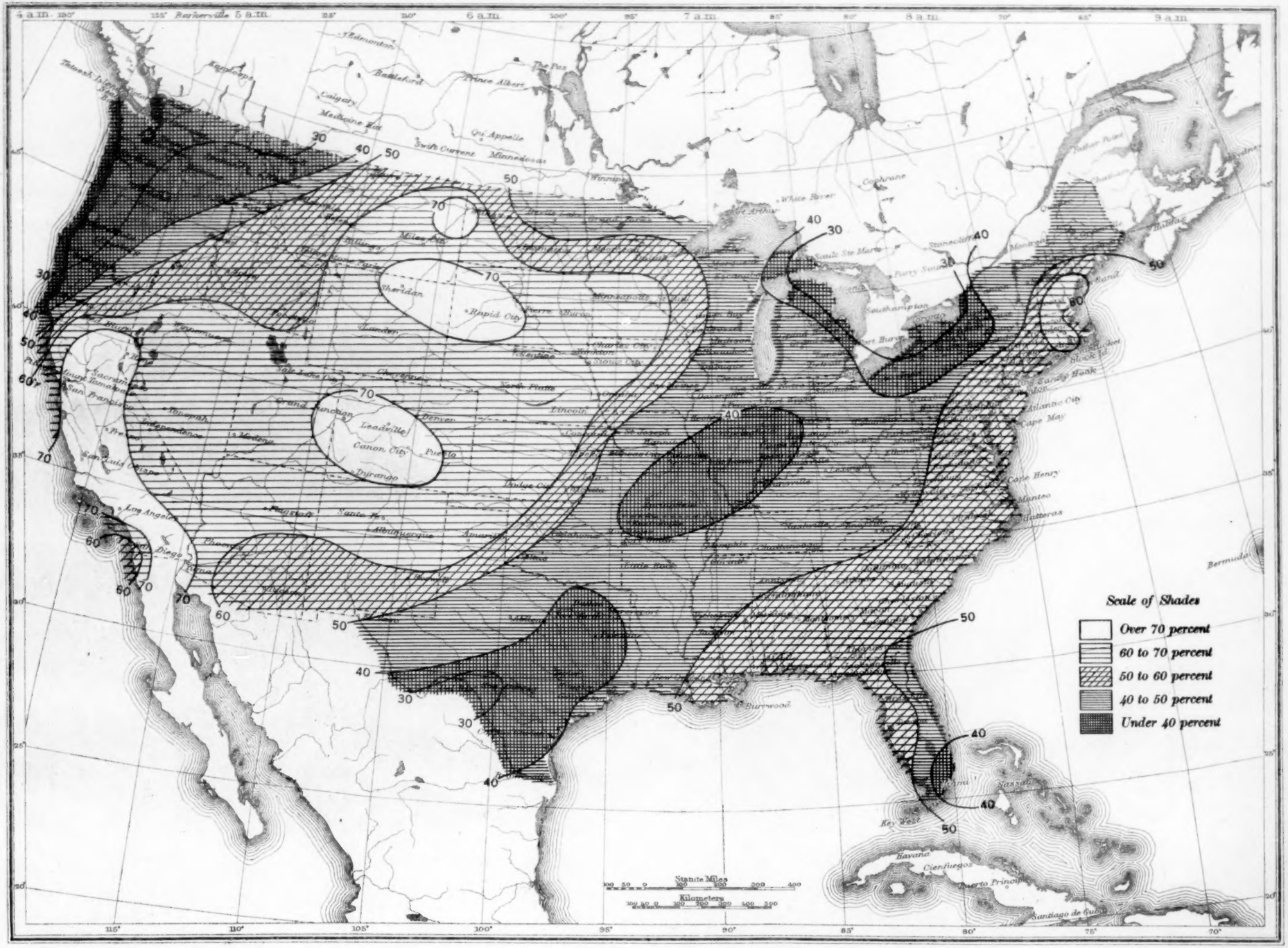


Chart V. Total Precipitation, Inches, November 1939. (Inset) **Departure of Precipitation from Normal**

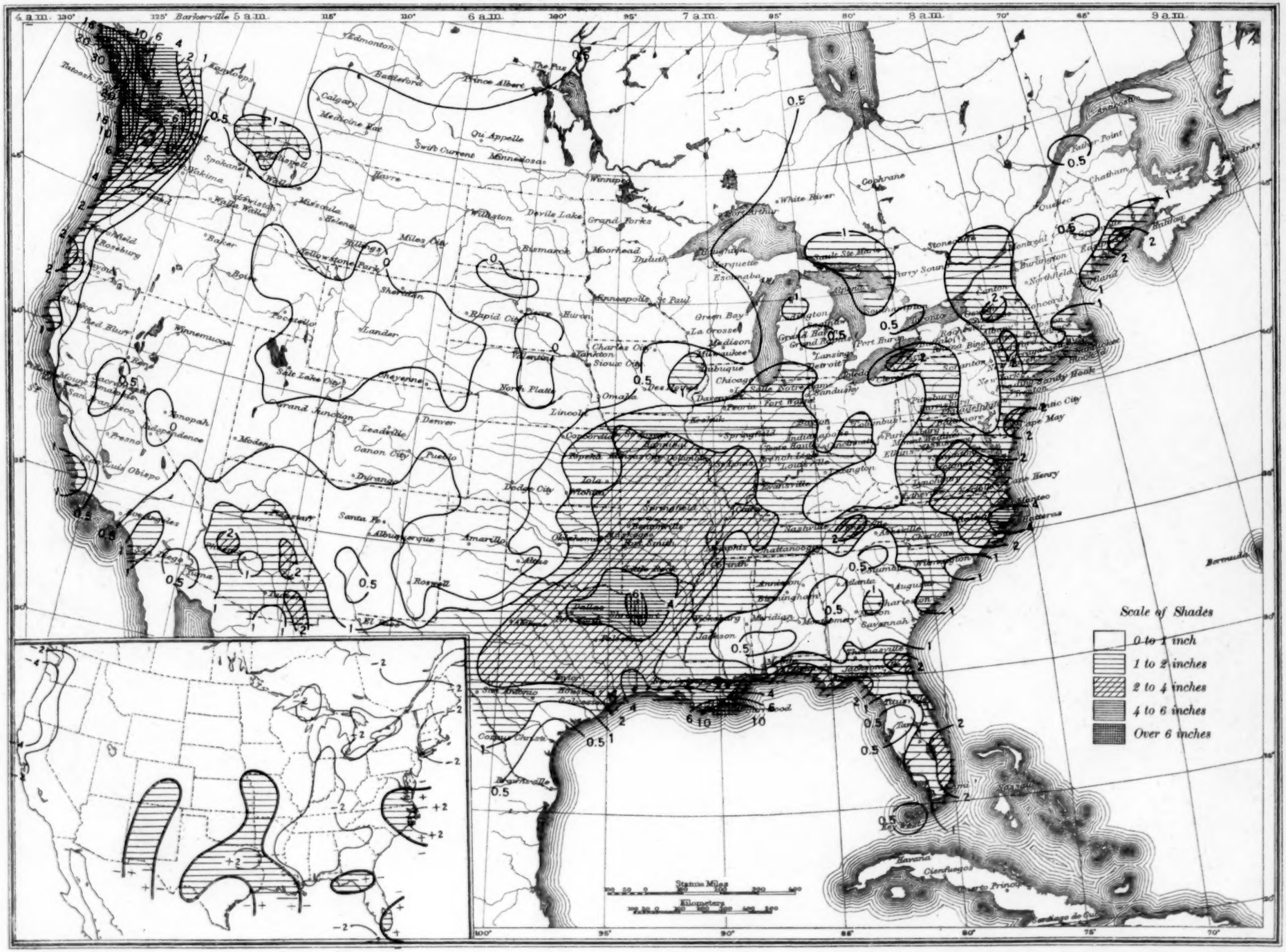


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, November 1939

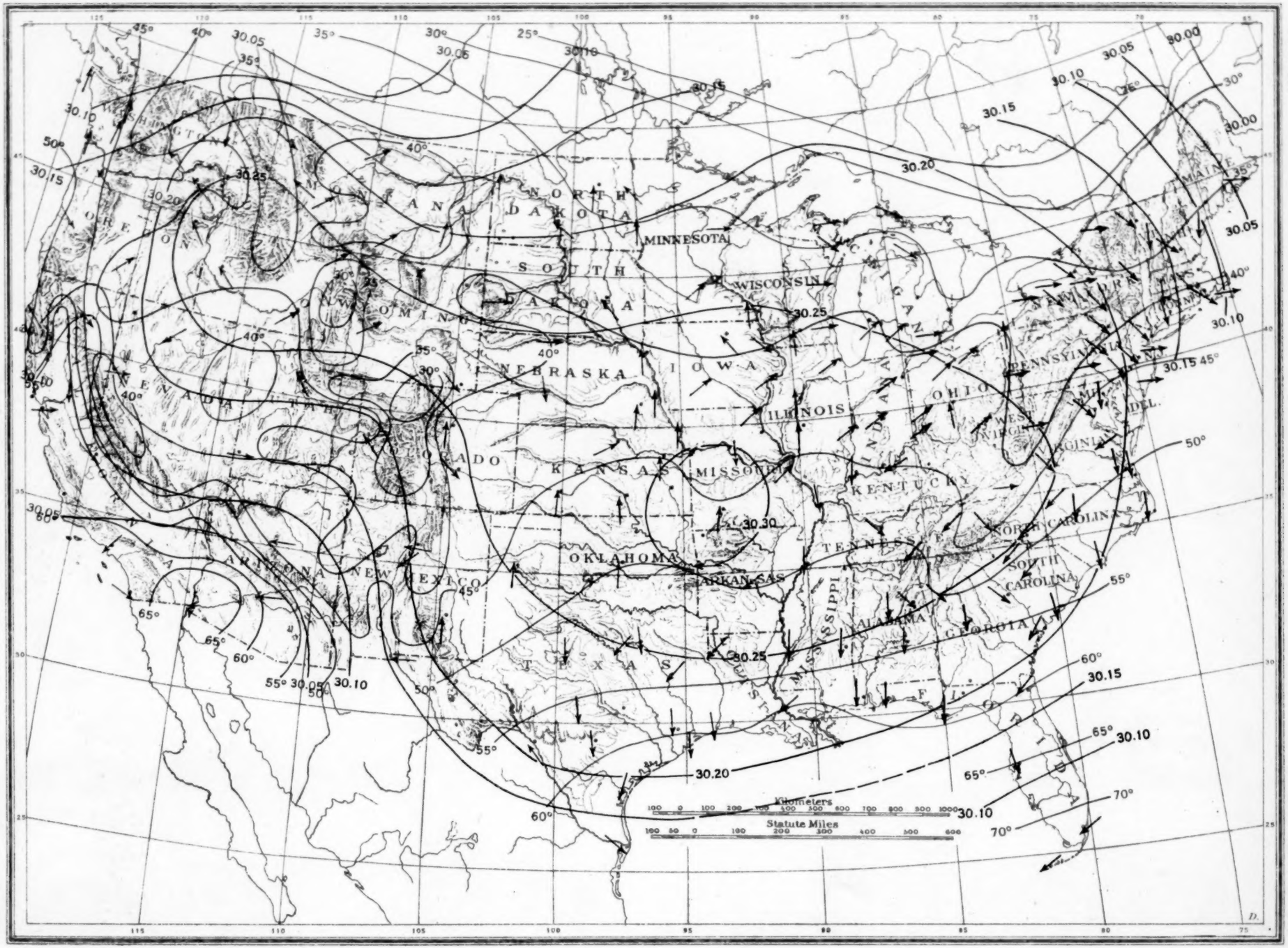


Chart VII. Total Snowfall, Inches, November 1939.

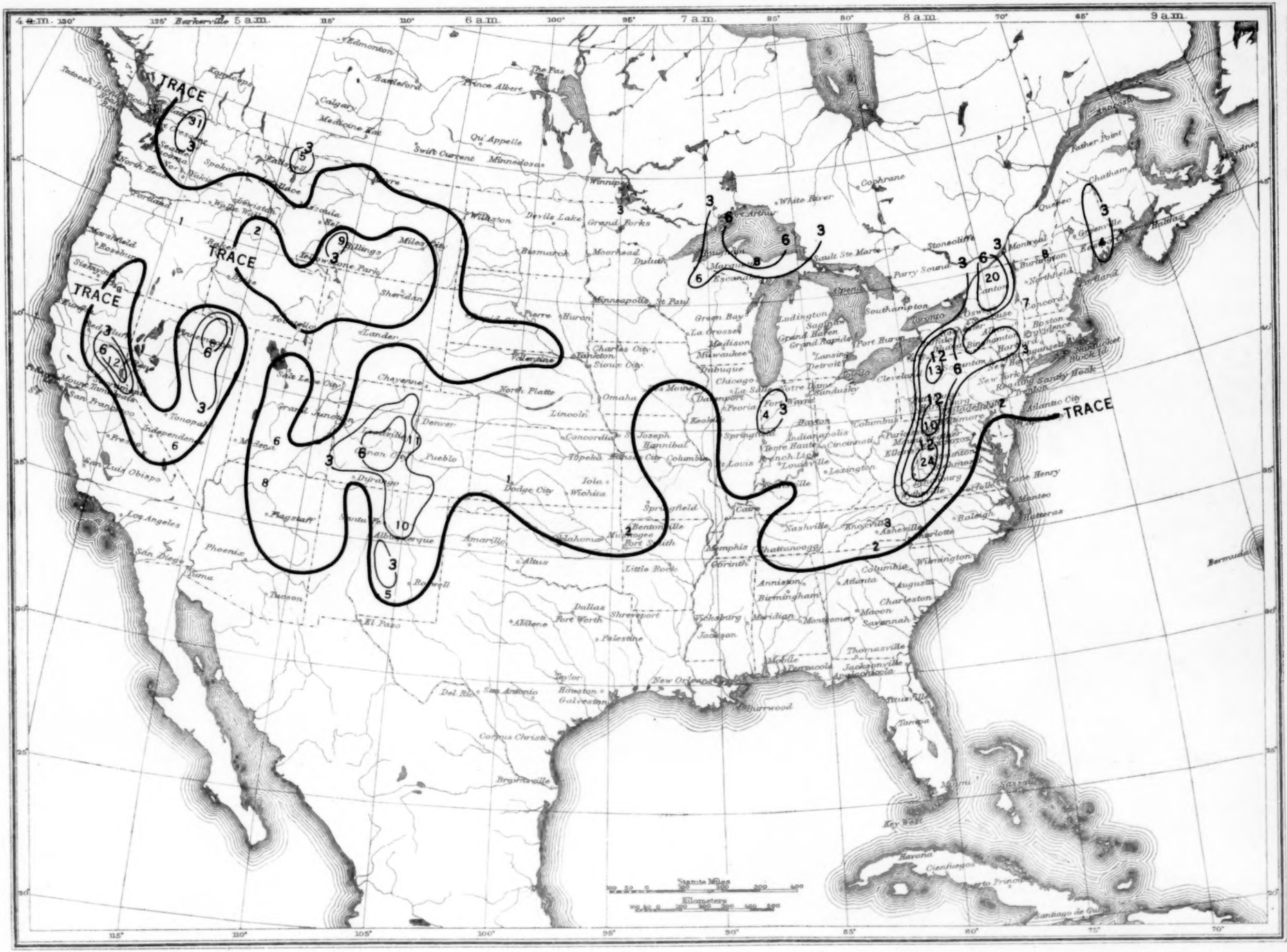


Chart VIII.—Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) November 1939

Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) November 1939

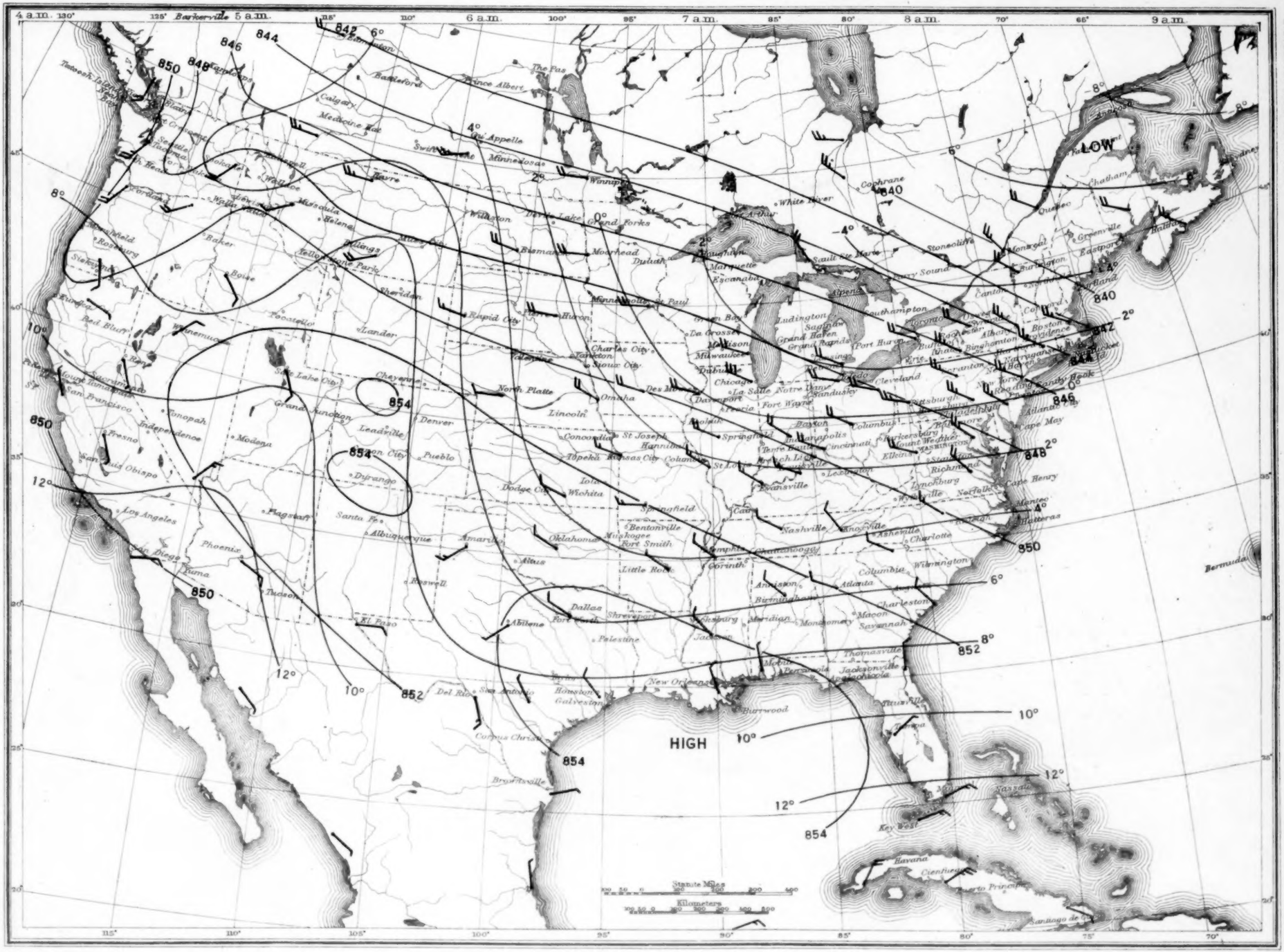


Chart IX. Isobars (mb) Isotherms (°C.) and Resultant Winds for 3,000 Meters (m. s. l.) November 1939

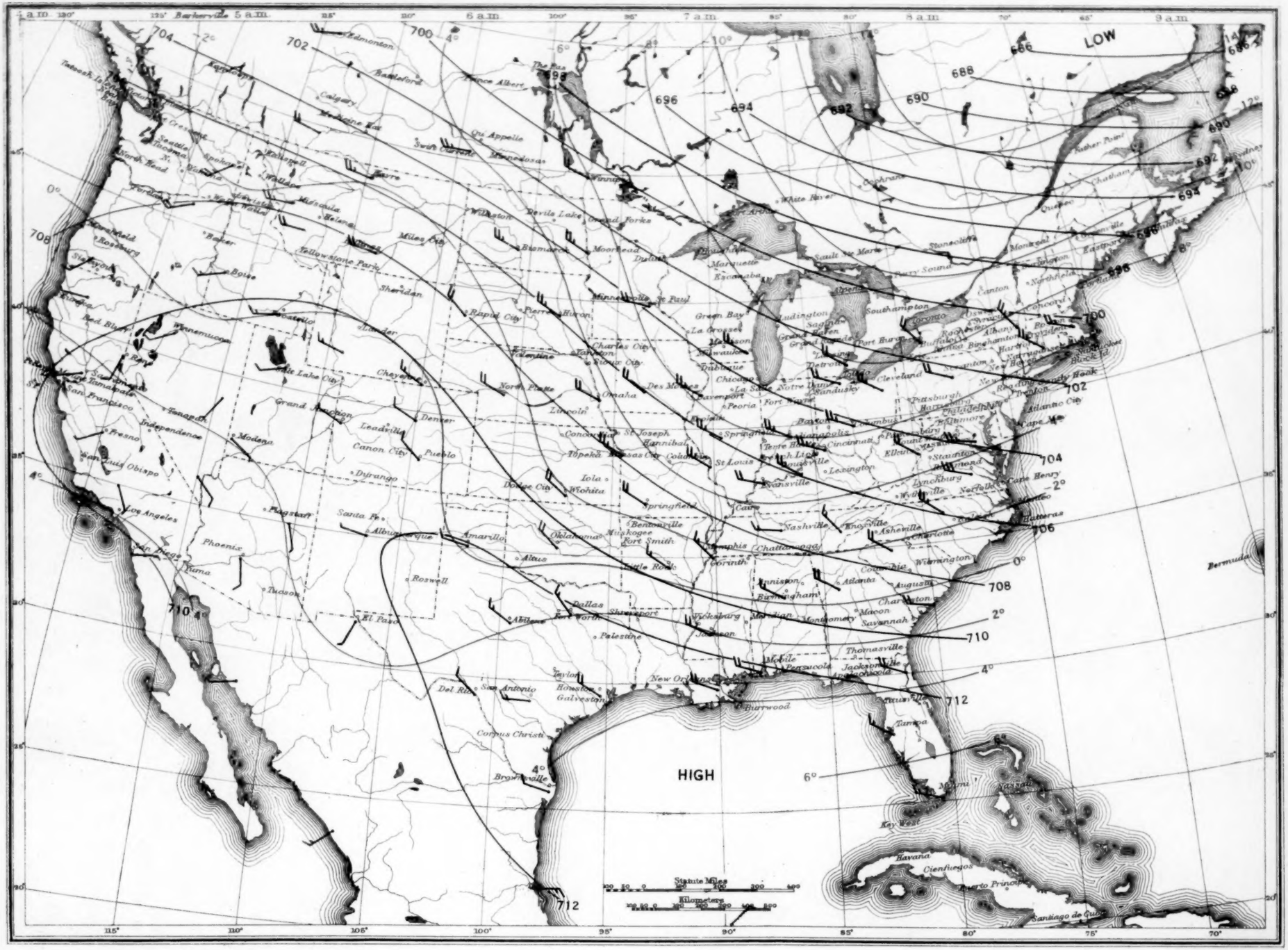


Chart X. Isobars (mb) Isotherms (°C.) and Resultant Winds for 4,000 Meters (m. s. l.) November 1939

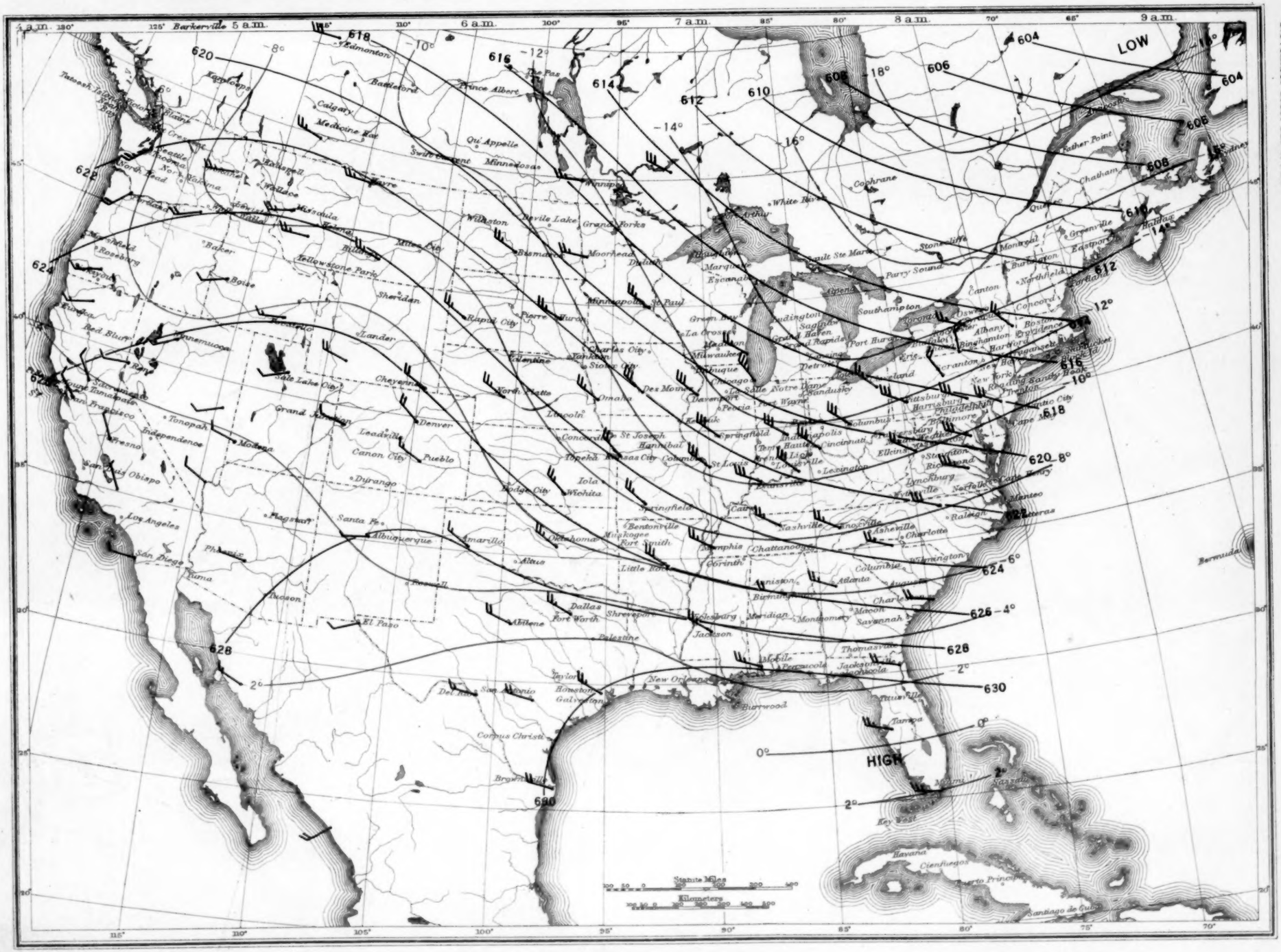


Chart XI. Isobars (mb) Isotherms (°C.) and Resultant Winds for 5,000 Meters (m. s. l.) November 1939

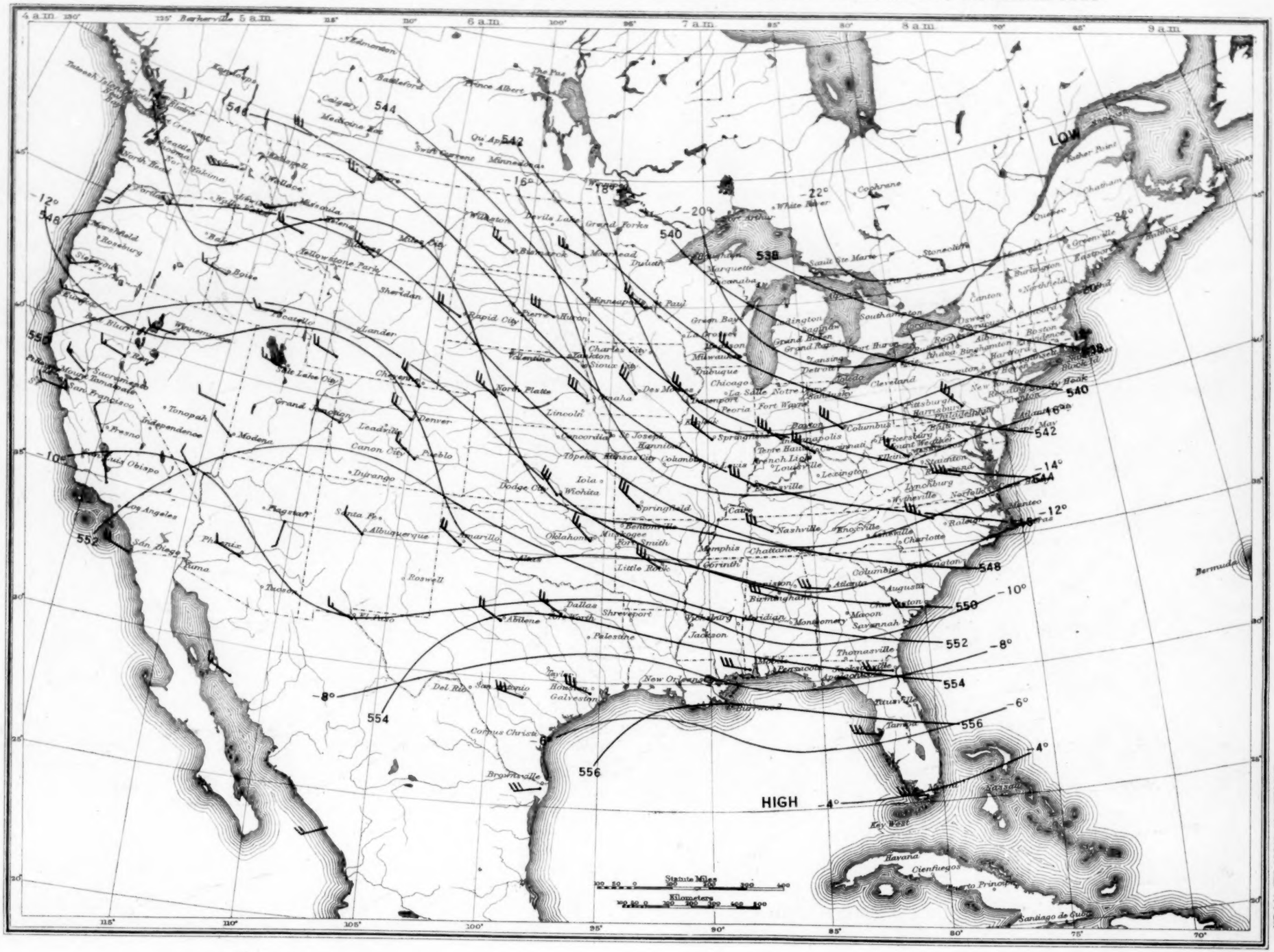
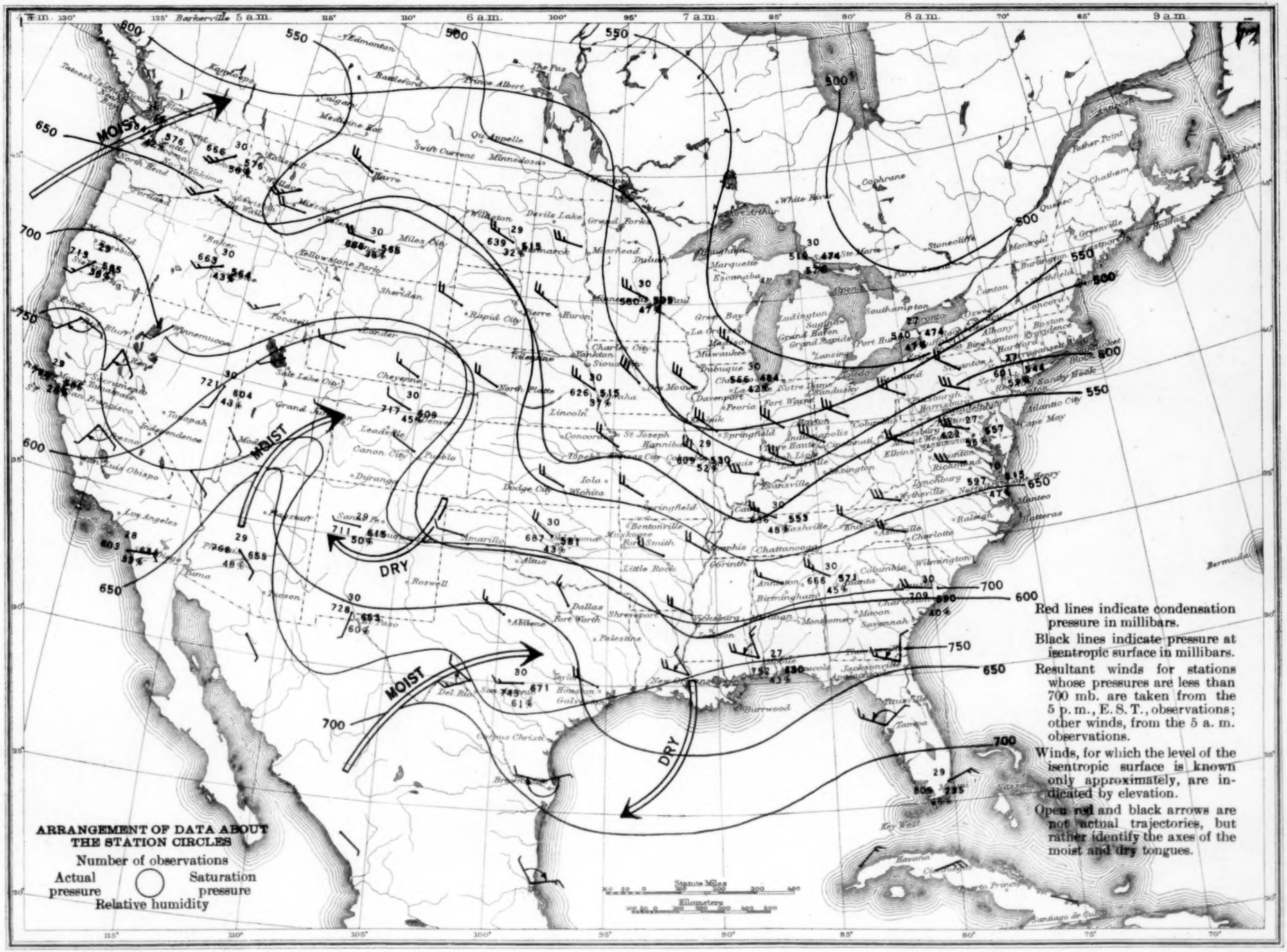


Chart XII. Mean Isentropic Chart, November 1939 (Potential Temperature 302° A.)


Red lines indicate condensation pressure in millibars.
Black lines indicate pressure at isentropic surface in millibars.
Resultant winds for stations whose pressures are less than 700 mb. are taken from the 5 p. m., E. S. T., observations; other winds, from the 5 a. m. observations.
Winds, for which the level of the isentropic surface is known only approximately, are indicated by elevation.
Open red and black arrows are not actual trajectories, but rather identify the axes of the moist and dry tongues.
ARRANGEMENT OF DATA ABOUT THE STATION CIRCLES
Number of observations
Actual pressure
Saturation pressure
Relative humidity
MOIST
DRY
Statute Miles
Kilometers